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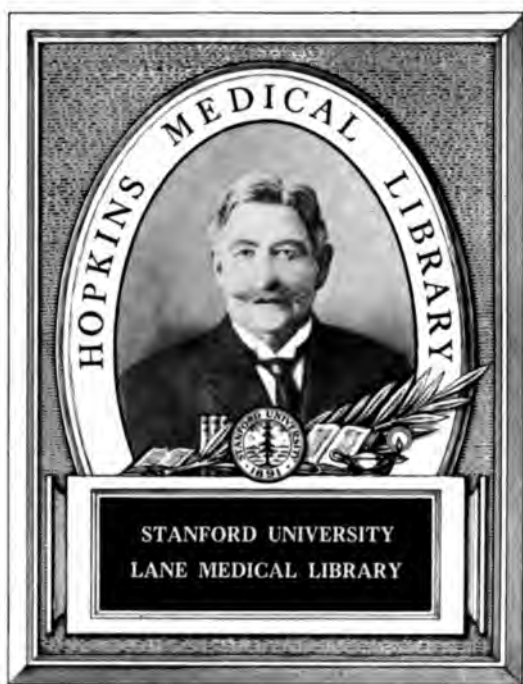
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AMERICAN ASSOCIATION
OF ANATOMISTS

Proceedings
of
Sessions 1-14

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THE
Association
of
American Anatomists,

Organized at Washington, D. C., September 17, 1888.

History, Constitution, Membership, and the Titles
and Abstracts of Papers, for the
years 1888, 1889, 1890.

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HISTORY.

The meeting of the Congress of American Physicians and Surgeons in Washington, D. C., in September, 1888, afforded a favorable opportunity to bring together the anatomists who were attending the Congress or who were already resident in the city.

A number of gentlemen interested in the matter met Sept. 17th in the lecture room of the Medical Department of Georgetown University and organized the "Association of American Anatomists."

The following gentlemen were present: Dr. Harrison Allen, Philadelphia, Pa.; Dr. Frank Baker, Washington, D. C.; Dr. William S. Forbes, Philadelphia, Pa.; Dr. Augustus C. Bernays, St. Louis, Mo.; Dr. W. W. Gray, Washington, D. C.; Dr. Horace Jayne, Philadelphia, Pa.; Dr. D. S. Lamb, Washington, D. C.; Dr. A. H. P. Leuf, Philadelphia, Pa.; Mr. Fred. A. Lucas, Washington, D. C.; Dr. Washington Matthews, U. S. A.; Dr. Geo. McClellan, Philadelphia, Pa.; Dr. W. B. Towles, University of Virginia; Dr. Faneuil D. Weisse, New York city; Dr. Jacob L. Wortman, Washington, D. C.

It was resolved that the object of the society should be the "advancement of the anatomical sciences." A constitution was adopted, and the management of the affairs of the Association was delegated to an Executive Committee of which the President and Secretary should be members *ex officio*. The committee was instructed to inform the professors and demonstrators of anatomy in the regular medical schools of the United States and Canada, as well as all others interested in the subject, of the formation and object of the Association and invite them to become members.

At the first meeting several papers were read, specimens were shown (see p. 13), and remarks were made. Dr. Joseph Leidy was elected President; Drs. Frank Baker and F. D. Weisse, Vice-Presidents; Dr. A. H. P. Leuf, Secretary, and an Executive Committee consisting of Drs. Harrison Allen, B. G. Wilder and W.

B. Towles, the President and Secretary acting *ex officio*. The meeting then adjourned.

CONSTITUTION.

The following is a copy of the constitution. Although brief, it has sufficed thus far for the needs of the Association :

SECTION 1. The name of the society shall be the "Association of American Anatomists."

SEC. 2. The Association shall have for its object the advancement of the anatomical sciences.

SEC. 3. The officers of the Association shall consist of a President, two Vice-Presidents, and a Secretary, who shall also act as Treasurer.

SEC. 4. The officers shall be elected by ballot every two years.

SEC. 5. The management of the affairs of the Association shall be delegated to an Executive Committee, consisting of its President, Secretary, and three other members.

SEC. 6. One member of the Executive Committee shall be elected annually.

SEC. 7. The Association shall meet annually, the time and place to be determined by the Executive Committee.

SEC. 8. Candidates shall be proposed in writing to the Executive Committee by a member. Each proposal shall be made at or before the first session of any regular meeting of the Association. The proposal shall state the official position or occupation of the candidate and the character of his investigations. The election shall take place by ballot in open meeting, a two-thirds vote being necessary.

SEC. 9. The annual dues shall be two dollars.

SEC. 10. The rulings of the Chairman shall be in accordance with "Robert's Rules of Order."

SEC. 11. Five members shall constitute a quorum for the transaction of business.

The affairs of the Association having been left in the hands of the Executive Committee it was decided to call the next meeting during the Christmas holidays of 1889. An attempt was made to meet at the same time and place as the Society of American Naturalists, since some were members of both societies. But lack of information respecting the plans of the sister society compelled the Association to come to an independent decision,

and the committee selected Philadelphia, where accordingly the second meeting was held, December 26 to 28, 1889.

The Philadelphia meeting proved very instructive and enjoyable. The Biological Department building of the University of Pennsylvania was put at the disposal of the Association. The members were entertained by the University through Dr. Horace Jayne, and by Dr. J. Ewing Mears; Dr. Harrison Allen and Dr. George McClellan entertained the members of the Association on the evenings of the 26th and 27th respectively. The mornings and afternoons of two days and a half were filled with the reading of papers, exhibition of specimens and discussions. Drs. Leidy and Baker presided alternately. The vacancy in the Executive Committee caused by the resignation of Dr. Towles was filled by the choice of Dr. Thomas Dwight. An amended constitution was adopted.

A committee on anatomical nomenclature was appointed consisting of Drs. Leidy, Allen, Baker, Stowell and Wilder. The committee made the following preliminary report at this meeting.

The Committee recommend:

1. That the adjectives DORSAL and VENTRAL be employed in place of *posterior* and *anterior* as commonly used in human anatomy, and in place of *upper* and *lower* as sometimes used in comparative anatomy.
2. That the cornua of the spinal cord, and the spinal nerve-roots, be designated as DORSAL and VENTRAL rather than as *posterior* and *anterior*.
3. That the costiferous vertebrae be called THORACIC rather than *dorsal*.
4. That the *hippocampus minor* be called CALCAR; the *hippocampus major*, HIPPOCAMPUS; the *pons Varolii*, PONS; the *insula Reilii*, INSULA; *pia mater* and *dura mater*, respectively PIA and DURA.

Signed by all the members.

JOSEPH LEIDY, *Chairman*,
HARRISON ALLEN,
FRANK BAKER,
THOMAS B. STOWELL,
BURT G. WILDER, *Secretary*.

Thomas Dwight was added to the committee.

The Committee desire frank and full expressions of opinion from scientific and medical journals, from individuals who receive copies, and from any others who are interested in the subject.

The third meeting was held in Boston, December 29 and 30, 1890, in the Anatomical lecture room of the Harvard Medical School. The second Vice-President, Dr. Weisse, presided; Dr. Dwight acted as temporary secretary, and Dr. Lamb was elected for the unexpired term. The Executive Committee decided to call the next meeting in Washington, D. C., in September, 1891. A reception was given to the Association and to the Society of American Naturalists, and the American Physiological Society, which were also meeting in Boston at the same time, by Professors H. P. Bowditch, Thomas Dwight and C. S. Minot, in the Anatomical Museum of Harvard Medical School.

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LIST OF PAPERS.

READ AT THE FIRST OR WASHINGTON MEETING, SEPT. 17 AND 18, 1888.

Dr. A. C. Bernays, St. Louis, Mo.

"Some points connected with the formation of the valves and openings of the heart."—Illustrated by diagrams.

Dr. J. L. Wortman, Washington, D. C.

"The significance of the hyoid bone in anthropology."—Illustrated by specimens. (Published in *The American Anthropologist*, Vol. II, 1889, p. 81.)

Dr. Harrison Allen, Philadelphia, Pa.

"The bipartite malar bone in the American Indian."—Specimens and remarks. (The paper was incorporated with a clinical lecture on the skull, "Toner" lecture, 1889.)

Dr. A. H. P. Leuf, Philadelphia, Pa.

"Case of non-decussation of anterior pyramids in a human female."

The same.

"Study of the topography of some human cerebral hemispheres."

Dr. D. S. Lamb, Washington, D. C.

"The junction of the eighth costal cartilage with the human sternum."—Specimens and remarks. (Published in *The American Anthropologist*, Vol. II, 1889, p. 75.)

AT THE SECOND OR PHILADELPHIA MEETING, DEC. 26 TO 28, 1889.

Dr. Frank Baker, Washington, D. C.

"Anomalies of the infraclavicular region."—Illustrated.

Dr. W. P. Wilson, Philadelphia, Pa.

"Plant morphology, especially of the so-called pitcher plants."—Illustrated by diagrams and specimens.

Dr. George A. Piersol, Philadelphia, Pa.

"Development of pigment within the epidermis."—Illustrated by drawings. (Published in the *University Medical Magazine*, August, 1890.)

Dr. D. S. Lamb, Washington, D. C.

"Olecranon perforation."—Illustrated by specimens. (Published in *The American Anthropologist*, Vol. III, 1890, p. 159.)

Dr. George T. Kemp, Brooklyn, N. Y.

"The form and probable function of the blood plaque."—Micro-photographs and remarks. (Published originally in *Studies from Biological Laboratory of Johns Hopkins University*, Vol. III, 1885-6. With additions.)

Dr. John A. Ryder, Philadelphia, Pa.

"The eye, ocular muscles and lachrymal glands of the shrew mole (*Blarina talpoides*)." (Published in the *Proceedings of the Philosophical Society*, XXVIII, 1890.)

Dr. B. G. Wilder, Ithaca, N. Y.

"The relation of the thalamus to the paracoele (lateral ventricle)," especially in the apes. (See American Neurological Association, Trans. 1888, pp. 313 to 320. *Journal of Nervous and Mental Diseases*, July, 1889. *Reference Handbook of the Medical Sciences*, VIII, § 178, 179.)

Dr. N. E. Brill, New York City.

"The cornu Ammonis, particularly in reptiles."—Illustrated by colored sections. (Published in *New York Medical Record*, March 29, 1890.)

Prof. T. B. Stowell, Potsdam, N. Y.

"Spinal nerves of the cat."

Dr. Thomas Dwight, Harvard Medical School.

"Series of casts of the duodenum; with remarks." (See *Boston Medical and Surgical Journal*, 1890, Vol. I, p. 205.)

Mr. Fred. A. Lucas, Washington, D. C.

"Individual skeletal variation."

Dr. Charles K. Mills, Philadelphia, Pa.

"Anomalous human brains."—Specimens with remarks.

Dr. Joseph Leidy, Philadelphia, Pa.

"Anomalies of the interior of the temporal bone in man."—Specimens and remarks.

Dr. J. L. Wortman, Washington, D. C.

"Teeth of the American Indians."—Illustrated by specimens.

Dr. E. C. Spitzka, New York City.

"Nuclear anatomy of the cetacean brain."—Remarks.

Dr. D. S. Lamb, Washington, D. C.

"The suprasternal rib."—Illustrated by specimens.

Dr. W. X. Sudduth, Minneapolis, Minn.

"Value of colored micro-photographs in demonstrating tissues."

Dr. Thomas Dwight, Harvard Medical School.

"Medico legal studies of the human skeleton."—Illustrated by specimens. (Published in *Boston Med. and Surg. Jour.*, 1890, Vol. I, p. 389 [cranial sutures]; and *Jour. Anat. and Phys.*, July, 1890, p. 527 [sternum]).

Prof. S. H. Gage, Ithaca, N. Y.

"Transition from stratified to columnar epithelium." (Published with additions in *Proc. Amer. Soc. Microscopists*, 1890.)

Dr. Harrison Allen, Philadelphia, Pa.

"The importance of the study of variations, as illustrated in the human teeth."—Remarks.

Dr. B. G. Wilder, Ithaca, N. Y.

"The heart as the basis of an intrinsic toponymy."

Dr. J. L. Wortman, Washington, D. C.

"The preparation and preservation of anatomical specimens for museums."—Specimens and remarks.

Dr. George A. Piersol, Philadelphia, Pa.

"Carmin staining for nervous tissues."—Illustrated by specimens and photographs. (Published in the American Monthly Microscopical Journal, December, 1889.)

Dr. John A. Ryder, Philadelphia, Pa.

"The genesis and the meaning of the biconcave form of vertebræ in the vertebrates." (Published in Proc. Amer. Philosoph. Soc., 1891.)

AT THE THIRD OR BOSTON MEETING, DEC. 29 AND 30, 1890.

Dr. S. J. Mixter, Boston, Mass.

"Corrosion preparations."—Illustrated by specimens from the Warren Museum of Harvard Medical School.

Dr. Thomas Dwight, Harvard Medical School.

"Studies on the spine."—Illustrated by specimens from the Warren Museum.

Dr. B. G. Wilder, Ithaca, N. Y.

"Macroscopic vocabulary of the brain, with synonyms and references."—Accompanied by printed lists. (Printed in part.)

Prof. S. H. Gage, Ithaca, N. Y.

"Comparison of the fibrin filaments of blood and lymph in Mammalia and Amphibia, with methods of preparation."—Illustrated by microscopic specimens and photographs.

Dr. Francis J. Shepherd, Montreal, Canada.

"The radio-carpal articulation."—Illustrated by specimens. (Published in Jour. Anat. and Phys., April, 1891.)

Dr. B. G. Wilder, Ithaca, N. Y.

"The brains of a sheep and cat lacking the callosum."—Illustrated by specimens and diagrams.

Dr. Charles Heitzmann, New York City.

"The structure of protoplasm, and mitosis."—Illustrated by specimens.

Dr. F. W. Langdon, Cincinnati, Ohio.

"Homology of the cerebro-spinal arachnoid with the other serous membranes." (Published in Medical Record.)

Dr. B. G. Wilder, Ithaca, N. Y.

"The relation of the cerebral to the olfactory portion of the brain."

Mr. P. H. Fish, Ithaca, N. Y.

"The partial occlusion of the olfactory lobe in the Canidæ."—Illustrated by microscopic sections and photographs. (Published in Monthly Microscopical Jour., 1891.)

ABSTRACTS OF PAPERS.

Of the forty papers and subjects presented at the three meetings, some have already been published, and it is expected that others will be.

The following fifteen (15) abstracts have been received :

BIPARTITE MALAR.

On the Bipartite Malar Bone in the American Indian.—Dr. H. Allen read a paper on the bipartite bone in the American Indian. He had examined twelve examples in each of which the suture was found extending across the bone from before backward in more or less complete condition. In two examples the bone was double on each side. To 1872 but nine examples were on record, namely, those made by J. B. Davis which had been found in the skulls of the Asiatic and Negro. In 1873, Prof. Wenzel Gruber described twenty-one examples, but no one had up to the time of my observations recorded this peculiarity in the skulls of any of the American race. The most of the specimens were of Peruvian origin; one was Seminole; one Pawnee and one Chickasaw.

ON THE JUNCTION OF THE EIGHTH COSTAL CARTILAGE WITH THE STERNUM.

Dr. D. S. Lamb presented a number of sternums showing the 8th costal cartilage reaching the sternum, sometimes on one side only, at others on both. When only on one side, so far as he had seen, it was confined to the right. These sternums were mostly, if not all, from colored people, and he thought that perhaps there might be something characteristic in this fact.

The discussion brought out the fact that the anomaly had not been observed by many of the members present.

THE OLECRANON PERFORATION.

Dr. D. S. Lamb read a paper and presented specimens of Olecranon Perforation.

The paper opened with a statement of the frequency with which the perforation occurred in the various collections of the Army

Medical Museum. The greatest frequency was found in a collection of prehistoric Arizona Indians, namely, 54 per cent. The examination covered in all 650 humeri, and seemed to establish—

1st. Its greater frequency in the ancient peoples.

2d. Its greater frequency on the left side.

3d. Its occurrence in adolescents, as well as mature individuals, in both sexes, and not confined to any one race.

An examination of its presence in the lower animals was next made to ascertain if any light could be thrown on its use and significance. The results showed a great variation for the different families, but a general uniformity in the individual families.

The literature was next examined, and a list appended, showing percentages in the different collections as recorded by Topinard and others.

Specimens of the anomaly were shown and the opinion given that the foramen was the result of atrophy occurring in youth after ossification had already taken place, and that the atrophy was due to pressure of the olecranon process.

The paper was discussed by Prof. Harrison Allen, Dr. J. L. Wortman, and others. It was read again before the Anthropological Society of Washington, February, 1890, and published in full, with illustrations, in the April number of the "American Anthropologist," page 159.

THE FORM AND PROBABLE FUNCTION OF THE BLOOD PLAQUE.

Dr. Geo. T. Kemp read the paper. It contained the gist of a piece of work published in "Studies from the Biological Laboratory of the Johns Hopkins University," Vol. III, p. 293, 1885-1886, together with some additional points obtained in continuing the work after that date. The plaques are normal constituents of the blood, and may be seen in blood drawn immediately into osmic acid or other hardening reagents. They have also been seen in uninjured blood vessels and in the circulation. As soon as blood is shed the plaques break down, going through a more or less characteristic series of changes *pari passu* with the formation of fibrin. Any reagent which preserves the plaques from undergoing change will prevent the blood from clotting,

although some reagents which prevent the blood from clotting do not preserve the plaques. The white blood-corpuscles do not break down during normal coagulation. The blood may clot and yet every leucocyte under observation remain unaltered. This has been verified in several hundred preparations, some of which have been kept surrounded by paraffin for days or even weeks. In leucocythæmic blood, the process of clotting is essentially the same as in normal blood. None of the leucocytes break down, while the plaques go through the same changes as in healthy blood.

In animals which have nucleated red corpuscles there are found oval or spindle corpuscles containing one large nucleus. These break down during coagulation, just as do the plaques in mammalian blood. These bodies have been claimed by Hayem and others to be young red corpuscles, or hæmatoblasts, and the same claim is made by Hayem for the plaques in mammals. I have never been able to satisfy myself of this hæmatoblastic function. Hayem claims that the bodies in question contain hæmoglobin after the animal has been subjected to a severe loss of blood. This I have never been able to substantiate. As far as the process of breaking down during clotting is concerned, I must certainly claim that these oval and spindle bodies are physiological analogues with the plaques of mammals. Whether they are their morphological homologues I am unwilling to state definitely.

The plaques in mammalian blood are small, frail, round or oval bodies, about one-third the diameter of the red discs. They are smooth in contour and surface, and are biconcave, though to a less extent than the red corpuscles. When the blood is drawn, the first change that takes place is that the plaques become granular and of irregular contour. At this stage they have a great tendency to stick together, or to any foreign body with which they come in contact. This enables us to make striking cover-glass preparations by drawing a drop of blood upon a cover-glass, and allowing it to stand about five seconds. Then wash it off by dipping it quickly once or twice into a dish of 75 per cent. NaCl solution, and then drop it into

1 per cent. osmic solution for twenty minutes or longer. The NaCl solution will wash away the red corpuscles which obscure the field, and the plaques will remain sticking to the cover-glass.

During the granular stage the plaques give out a hyaline exudate which dissolves in the plasma, and the granular remains of the plaques fuse more and more perfectly together, losing their individual identity, giving us characteristic granular masses. From the time of the formation of the hyaline masses the blood will clot, the fibrin is apt to be formed most thickly in the neighborhood of the granular masses, and often radiates out from these as centers. The fibrin and the granular masses are not identical, however, as they react differently with reagents.

The fibrin is deposited freely in the field, often totally independent of all corpuscular elements. The first appearance of fibrin (especially in blood diluted with 75 per cent. NaCl solution) is in long needle-like forms, which strongly suggest crystals, which probably they are. These grow larger and larger, and extend and join with each other and form thick fibrin threads. In thicker layers of blood there seems to be a jelly stage preceding the separation out of these fibrin needles.

In lesions to the wall of a blood vessel it is the plaques which first adhere to the wounded place and make the white thrombus around which the later fibrin thrombus forms. This is equally true of the spindle plaques in cold-blooded animals. One of the first changes which these undergo is to become round, and to resemble so closely a uninuclear leucocyte that they can not be distinguished. This is the reason that the first formation of thrombus has been almost universally ascribed to the white corpuscles; for the classical work on this subject is that of Zahn, and he used frogs for his experiments.

The granular masses formed from the plaques so closely resemble broken-down leucocytes, that it is no wonder that they have been generally described as such. A clear, good lens of high magnifying power (600 to 1,000 and upward) and *continuous* observation of one group of plaques during the whole stage of coagulation, are necessary to make out these points.

Photographs illustrating these points were shown.

THE RELATION OF THE THALAMUS TO THE PARACÆLE (LATERAL VENTRICLE) ESPECIALLY IN THE APES.

Prof. B. G. Wilder read a paper on this subject. Most of the points embraced in this paper are presented by the author in the "Journal of Nervous and Mental Disease," July, 1889, where, however, the non-reception of proof occasioned some errors and omissions; some are also discussed in the "Reference Handbook of the Medical Sciences," VIII, § 178, 179. Most figures of the paracælian floor in apes are either vague or positively incorrect in respect to the relations of the thalamus, paraplus, paratela, etc. In a chimpanzee supposed to be about four years old, there was found already the divarication of the fimbria and tenia, the margins of the rima, and the concomitant formation of the paratela; but on one side this is free while on the other it adheres to the thalamus. For the satisfactory determination of the condition of these parts, there must be examined well preserved ape brains at various ages, before, as well as after birth.

THE SPINAL NERVES IN THE DOMESTIC CAT.

Prof. T. B. Stowell read the paper. The present contribution to Comparative Neurology is offered in the hope that it may serve to strengthen the argument in favor of the substitution of Comparative Anatomy for Anthropotomy in the first year's work of our medical courses, and also to justify callisection or physiological experimentation.

If the educational or cultural in contradistinction to the utilitarian view of the subject be taken, there seems abundant demand for the work undertaken by the paper as a guide to laboratory students, with whom the end is general and not specific; for it is now quite generally conceded that comparative anatomy furnishes one of the most available means for training the perceptive activities of mind as well as those of comparison and induction. Furthermore, physiology is almost wholly a comparative science; but unless the student knows that the structures in the animal experimented upon are strictly homologous with structures in man, the physiological experiment becomes merely an illustrative exercise, interesting and instruc-

tive, but in no sense a demonstration of function in man. If the nerve supply is identical with the nerve supply in man, the experiments in which the nervous system is the controlling factor are conclusive evidence in human physiology and have corresponding value in therapeutics and pathology.

Among reasons for the selection of the domestic cat for the end sought (comparative neurology), may be briefly stated the following :

1st. The readiness with which structures may be homologized with those in man—the distribution of certain nerves in the dog are quite unlike that found in man, *e. g.*, vagi.

2d. The abundance of material for study.

3d. The inexpensiveness, (*a*) of the body, (*b*) of suitable preparation of the same, injection, etc., (*c*) of preserving for study.

4th. The ease of manipulation; the tissues in the cat are much firmer than they are in a small human subject, *fœtus* or infant.

5th. To these more apparent considerations may be added the fact that already elaborate works on Felitomy are accessible, *e. g.*, Straus Durckheim's monograph on the skeleton, ligaments and muscles of the cat, and the less expensive reduced copies with explanations by Prof. H. S. Williams; St. George Mivart's "The Cat," although this work does not seem to be a reliable guide to the study of American cats; the more scientific and accurate work of Wilder and Gage, entitled "Anatomical Technology," and the numerous papers and addresses of the same authors, a partial list of which is found in the work cited; and the papers embodying some of the writer's studies in Comparative Neurology, The Vagus Nerves, The Trigemini, The Facial, The Glossopharyngeal, The Accessory, The Hypoglossal Nerves, and The Soft Palate in the Domestic Cat.

PREPARATION.—The cats are killed with chloroform, and both arteries and veins are injected with the starch injection mass. When not in use, the body is wrapped in a napkin saturated with alcohol and then placed in a closed receptacle; the tissues, by this means, are preserved in excellent condition.

The integument is divided just sinistrad of the meson, and is

removed as the dissection progresses. The necessity of leaving the integument *in place* appears when it is remembered that many terminal rami of the spinal nerves are cutaneous. It is not imperative that the dissection begin at any particular point, but it will be found convenient to trace the nerves in groups, *i. e.*, the cervical, the thoracic, the lumbar, etc. If the dissection is commenced at the cephalic region, the following suggestions serve as a general guide: Remove the integument and the muscle from the sinistral side of the caudal portion of the neck and the cephalic region of the thorax, to the level of the vertebral laminæ, exposing the 5°, 6°, 7°, cervical vertebræ and the 1° and 2° thoracic. Find the spinal nerves just peripherad of the arch, and trace the same centrad to the intervertebral foramina (foramina of exit), and with the tracer separate the connecting tissue from the vertebræ; then remove the neural arch of the thoracic vertebræ with side-cutting nippers, making the first incisions near the neurapophysis, in order to insure protection to the myel; after the exposure of the myel and thoracic nerves is thus made on the sinistral side, the arch can be removed cephalad and dextrad, or caudad as the dissection requires. It will be noticed that the 1° and 2° thoracic nerves join the 5° and 6° cervical in the brachial plexus.

There are advantages in beginning with the ventral division of the 2° cervical nerve, N. auricularis magnus; but the danger of destroying the dorsal ganglion is so great that another portion of the neuraxis is recommended.

The body of the paper, with detailed descriptions and plates, is to be published elsewhere.

CONCLUSION.—The study of the nervous system of the domestic cat demonstrates that the distribution of the terminal rami of nerves is so identical with those in man, that with the exception of the increased number of caudal nerves, the cat is an excellent substitute for the human cadaver for the beginner in comparative neurology; and second, it would seem to prove that the nervous system is preferable to the skeleton and the muscles as the basis of Comparative Anatomy.

INDIVIDUAL SKELETAL VARIATION.

Mr. Fred. A. Lucas read a paper entitled "Individual Skeletal Variation," noting that the question, to what extent may a species normally vary, was one somewhat difficult to answer, owing to the fact that the extensive series of specimens needful for the solution of the problem were seldom available.

Mr. Lucas cited instances of extensive skeletal variation in the orang, mule deer, various birds and urodele batrachians, although basing most of his remarks on the large series of bones of the great auk in the U. S. National Museum.

The great auk was shown to be variable in the amount of development of the various vertebral processes, in the weight and length of the long bones, in the character of the posterior margin of the sternum, in the number of ribs attached to the sternum, in the number of ribs, and in the development of the sacral vertebræ.

Mr. Lucas briefly discussed the question of correlation of size between bones from the right and left limbs, illustrating his remarks by diagrams. His conclusions were that many skeletal variations are reversionary in character, some progressive and some due to physiological causes; most, if not all, having some definite meaning.

ANOMALIES OF THE INTERIOR OF THE TEMPORAL BONE IN MAN.

Prof. Joseph Leidy exhibited specimens of the human temporal bone, with the tympanic cavity exposed, exhibiting a wide difference in its capacity in different ones. While there is comparatively little difference in the atrium in different individuals, the attic and especially the antrum vary greatly.

THE EIGHTH STERNAL RIB.

Dr. D. S. Lamb, read the paper. It began with the statement that the author had frequently observed this anomaly in the human subject, and especially in individuals of the Negro race. But that inasmuch as most of the examinations of the dead in the locality of Washington were of this race, perhaps he might be in error in thinking the anomaly had some racial value.

He quoted the scant literature of the subject and referred to the circular letter of Surgeon John S. Billings, U. S. A., asking for information.

A brief statement of the history of development of the sternum was made; the number of sternal pieces and their relation to the cartilages considered, both in man and the lower animals. The effect of broadening the sternum in reducing the number of cartilages articulating with it was noticed; that in the female it usually was broader than in the male, and perhaps this fact explained the results of Prof. Cunningham's researches, namely, that he found the anomaly twice as often in the male as female.

The author rather accepted the explanation offered by Cunningham, that the additional cartilage was to increase the basis of support of the upper limb.

The subject was a good deal discussed and showed much difference of opinion.

To be published in full.

THE TRANSITION FROM STRATIFIED TO COLUMNAR EPITHELIUM.

Prof. Simon Henry Gage, of Cornell University, Ithaca, N. Y., read a paper on this subject. He said that, so far as he had investigated the mode of transition from stratified to columnar epithelium—

1. It was not abrupt, histologically speaking, but gradual.
2. The columnar epithelial cells did not seem to be enlargements of the deepest cells of the stratified epithelium, for they first appeared upon the free surface of the horny layer instead of in the deepest layer, as affirmed by many authors.
3. The two kinds of epithelium were beveled and overlap, the columnar epithelium resting upon the stratified, as if the stratified had been pushed under the columnar.

THE IMPORTANCE OF STUDY OF VARIATION, AS ILLUSTRATED IN THE HUMAN TEETH.

The speaker, Dr. Harrison Allen, alluded to the importance of an initial cusp—the protocone, as named by Osborne—but the author had many years ago, namely, in 1873, announced that

very compound teeth include an initial cusp, which is analogous to the canine or incisor tooth. The variations of the human teeth are best seen when this initial cusp has a second cusp, by which it is converted into the bicuspid form. The speaker spoke particularly of the variation in the lower bicuspid of the human jaw, in which an incipient paracone has been developed. In the lower bicuspid many varieties were spoken of. The speaker next described what he named the ellipsoid crown, which is peculiar to the first upper molar. The crown is that of an ellipsoid whose long axis is oblique to the axis of the dental arch, instead of being in the line of the dental arch, as is the case in the normal tooth; the roots are always confluent. The second of the three molars, when the ellipsoid shape of the first molar is present, is invariably tritubercular; the third is nondescript. This arrangement is peculiar to man, and it is not a reversion to the tooth structure of the lower types. Dr. Allen further spoke of the parallel which can be drawn between the shapes of the human teeth and those which are characteristic in the lower animals.

THE HEART AS THE BASIS OF AN INTRINSIC TOPONYMY.

Prof. B. G. Wilder read a paper on this subject. The paper called attention to the fact that the recognition of even the right and left sides is conventional, but that, with man and other mammals, the heart is rather left than right, rather ventral than dorsal, and rather cephalic than caudal. Hence, of the eighths into which the body proper (excluding the head, neck and limbs,) might be divided by planes representing the three dimensions of a solid, one, the ventro-sinistro-cephalic, is characterized by the presence of a rhythmically contractile muscular organ; that eighth is cardiac, the others are acardiac.

COMPARISON OF THE FIBRIN FILAMENTS OF BLOOD AND LYMPH IN MAMMALIA AND AMPHIBIA, WITH METHODS OF PREPARATION.

Prof. S. H. Gage read the paper. The salient points in the comparison are:

1. The fibrin filaments of mammalian blood and lymph are in

the form of a coarse net-work, showing markedly in blood fibrin a kind of rosette arrangement.

2. The fibrin filaments obtained from the blood and lymph of amphibia are also in the form of a net-work, but the arrangement is not so distinctly in rosettes, and the filaments forming the net-work are exceedingly fine, so fine that it requires a homogeneous immersion objective and very careful illumination to obtain satisfactory views of them.

3. While the time required for coagulation was markedly less in the amphibia than in mammals, that did not seem to have anything to do with the fineness of the fibrin net-work as determined by cases of especially rapid coagulation in mammalian blood or lymph or of exceptionally slow coagulation in amphibian blood or lymph.

METHODS.—Perfectly fresh blood was put upon a glass slide or cover-glass, and the cover-glass placed on the slide and pressed down to avoid too thick a layer. The cover was allowed to project slightly so that it could be grasped. The slides were kept in a moist chamber for from ten minutes to twenty-four hours; the cover was then raised and the layer of fibrin, usually adhering to the cover, was washed with normal salt solution to remove most of the blood corpuscles and soluble proteids, then stained either with haematoxylin and eosin, or with picric acid. After staining, the cover-glass preparations are allowed to dry, and are mounted over a shallow shellac cell. The filaments show with extreme sharpness in this way, and are especially well adapted for photographing.

STRUCTURE OF PROTOPLASM, AND MITOSIS.

Dr. Charles Heitzmann read the paper. He said that in the year 1873, he had published in the Vienna Academy of Sciences the results of researches made on living protoplasmic bodies, proving the presence of a reticulum of living matter in the protoplasm at a certain stage of its development. This assertion had ever since been mooted, for other observers have claimed that the reticulum is caused by the addition of certain reagents. Stricker of Vienna, in the "Arbeiten aus dem Institute für Allg.

u. Experimentelle Pathologie, 1890," publishes a micro-photograph of a fresh living colored blood corpuscle of a *Proteus* of the Adelsberg cave, made by means of the electric microscope with a power of 2,500 diameters. In this photograph the granules appear interconnected through delicate conical offshoots, whereby a reticulum is established throughout the protoplasmic lump. Thus his (Heitzmann's) assertion was corroborated, and there could be no further doubt as to the presence of such a reticulum.

The discovery of Karyokinesis or Mitosis, by Schleicher, apparently contradicted the assertion of Heitzmann, that the nucleus is composed of the same material that builds up the reticulum, namely, living or contractile matter, since the split up nucleus and its loops were apparently in no connection with the reticulum of the protoplasm. Hence the peculiar denominations, "Nucleus," "Chromatin," &c., for the substance of the nucleus. Heitzmann proves that the staining procedure with saffronin and the subsequent mounting in Canada balsam have been the reason of the disappearance of the finer connections. The stains are taken up only by coarser formations of the living matter, whereas the more delicate formations remain unstained and are rendered invisible by the mounting process. Fresh specimens of protoplasmic bodies or those treated with weak solutions of chromic acid and mounted (in the latter instance) in glycerin, will not show distinct karyokinetic figures, but plainly demonstrate the connections of the loops, in all stages of indirect division, with the recticulum in the surrounding protoplasm, by means of delicate conical offshoots. These connections are missing only when the nucleus is suspended in a plasmatic space and temporarily isolated. Heitzmann demonstrated the connections of the nucleus in different stages of karyokinesis with the reticulum, with immersion lenses of 1,000 amplification.

He claims that the whole organism being built up by protoplasm, the reticulum pervades not only the protoplasmic bodies, so called "cells," but also the basis or intercellular substances, which latter are nothing but chemically-transformed protoplasm. This assertion holds good for all the tissues of animal and vegetable organisms. In the former we meet with isolated protoplas-

mic bodies only in the liquids (blood, lymph, etc.), which do not deserve the name of tissues at all. Thus we explain the fact that not only the "cells," but also the basis substances, after the setting free of their amount of living matter, actively participate in the process of inflammation or formation of tumors, in proliferation and increase of living matter. This view has been adopted by Stricker for the last ten years.

In the face of such facts, the cell theory must fall to the ground. Heitzmann's views have greatly gained acknowledgment in the last few years by the researches of Goodale, of Cambridge, and Gardner, of England, who demonstrated the presence of a reticulum in both protoplasm and cement substances of plants. Plants, therefore, are not built up by individual cells, just as little as are animal organisms.

THE PARTIAL OCCLUSION OF THE OLFACTORY LOBE IN THE CANIDÆ.

Mr. Pierre A. Fish. After a brief epitome of the literature of the subject, the author alludes to the condition of the olfactory lobe as seen in the mammalian embryos generally. He claims that the lobe in the dog is anomalous, inasmuch as the ectal evidence is that of a macrosmatic form, while at the same time that the cavity is almost totally occluded. The author found in a transection of the dog's olfactory bulb about the middle of its length a small normal rhinocœle; at the crus, however, the occlusion became complete. The rhinocœle was particularly distinct in the dingo. The author concludes that the closure of the bulb is but partial, and, therefore, that the statement of previous writers must be modified.

OFFICERS FOR THE YEAR 1890-'91.

DR. JOSEPH LEIDY, of Philadelphia,	President.
DR. FRANK BAKER, of Washington, D. C.,	1st Vice President.
DR. FANEUIL D. WEISSE, of New York City,	2d Vice President.
DR. D. S. LAMB, of Washington, D. C.,	Secretary and Treasurer.

EXECUTIVE COMMITTEE.

DR. HARRISON ALLEN, of Philadelphia,
 DR. BURT G. WILDER, of Cornell University,
 DR. THOMAS DWIGHT, of Harvard University, and the
 PRESIDENT and SECRETARY, *ex-officio*.

NOTICE.—The fourth (4th) annual meeting will be held in Washington, D. C.,
 at the same time as the Congress of American Physicians and Surgeons.

PROCEEDINGS
OF THE
FOURTH ANNUAL SESSION
OF THE
Association
of
American Anatomists,

Held at Washington, D. C., September 23, 24 and 25, 1891,

TO WHICH IS APPENDED A
LIST OF MEMBERS.

WASHINGTON, D. C.
GERSFORD, PRINTER, 617 E STREET.
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PROCEEDINGS OF THE FOURTH SESSION.

The fourth annual session of the Association was held in Washington, D. C., September 23 to 25, 1891, at Grand Army Hall, 1412 and 1414 Pennsylvania avenue. In consequence of the death of the president, Dr. Leidy, Dr. Baker, first vice-president, acted as president.

Dr. Lamb, the secretary and treasurer, made his report, covering the period since the third meeting at Boston, December, 1890. The following are extracts :

"The Executive Committee decided to publish a pamphlet containing a history of the Association, its Constitution, its membership, the titles of papers read at its three meetings and the abstracts of papers as far as received. It was found that many papers had already been published. * * * One copy was sent to each member, and additional copies to those desiring them. Other copies were sent to the officers of the Congress of American Physicians and Surgeons; others also to a few medical journals, and others to learned societies at home and abroad." * * *

"This question of admission of this Association to the Congress of Physicians and Surgeons, which had been pending for some time, was finally decided in the affirmative. Dr. Pepper notified me of this decision July 31st." * * *

"A matter of some interest to the Association is, I think, the geographical distribution of the members. The four largest numbers are: From Pennsylvania, 19; New York, 14; District of Columbia, 9, and Massachusetts, 7—constituting much more than half the membership; then Virginia, Illinois and Canada, each 3; Maine, Connecticut, Louisiana and California, each 2; New Jersey, Maryland, Tennessee, Missouri, Texas, Ohio, Michigan, Wisconsin, Minnesota, Kansas, Nebraska, Colorado and U. S. Army, each 1." * * *

"In view of the great preponderance of a few localities I have sent copies of the program to a large number of anatomists in the unrepresented districts, hoping to awaken there an interest in the Association.

"I have received up to date from dues, \$42, which, added to the \$230 from Dr. Leuf, makes a total of \$272. I have expended for postal cards, stamps and wrappers, \$16.32; for telegrams, 91 cents; for transcribing, 50 cents; and for printing, including the printing of the pamphlets, \$62.15; making a total expended of \$79.88. Balance on hand, \$192.12. The amount of dues in arrears is \$48. It will be seen that the expenses average about one dollar a member."

The Auditing Committee, Drs. Shufeldt and Gerrish and Mr. Lucas, reported the Treasurer's accounts correct.

The Committee on Nomenclature reported progress.

The following amendment, proposed by Dr. Allen, a substitute for the present Section IX of the Constitution, was laid over till next meeting: "An annual assessment shall be made to meet the expenses of the Association."

The following amendment to Section VIII was adopted: "Honorary members may be elected from among those not Americans who have distinguished themselves in anatomical researches."

The following was adopted in regard to the death of Dr. Leidy:

"WHEREAS, Dr. Joseph Leidy, our late President, whose name is known throughout the civilized world as an anatomist, died in Philadelphia, April 30, 1891,

"*Resolved*, That this Association herewith expresses its deep sense of the great loss which it has sustained in common with the scientific world."

The Executive Committee was directed to investigate and adjust the accounts of the late Secretary and Treasurer.

The following was adopted:

"WHEREAS, The subject of the comparative anatomy of race is an important one, and special advantages for the observation and collection of material therefor are afforded among the negro race in North America,

"Resolved, That the Association recommend that a circular be prepared by the Executive Committee for distribution among the anatomists of North America, inviting co-operation.

"Resolved, Second, That the Executive Committee is authorized to incur a cost in printing and distributing these circulars to an amount not exceeding twenty-five dollars."

The following new members were elected: Balloch, Campbell, Carr, Craig, Cunningham, Dercum, Ewing, Foster, Herrick, Hodge, Moran, Morgan, Parmenter, Reyburn and West; total, fourteen active, one honorary. (See list of members p. 13.)

The following officers were elected: (See p. 7.) The sense of the meeting was that this election was for two years.

The following papers were read: (See p. 9.)

A reception to the members of the Congress was given by the President of the United States, September 24th, at 2 P. M.

The Association was entertained at the National Zoölogical Park in the afternoon of September 23d, by Dr. Baker, the Acting President, who was also the Manager of the Park.

An abstract of the proceedings of this meeting was published in the "Medical News," Philadelphia, Oct. 17, 1891, pp. 466-7.

CONSTITUTION.

SECTION 1. The name of the society shall be the "Association of American Anatomists."

SEC. 2. The Association shall have for its object the advancement of the anatomical sciences.

SEC. 3. The officers of the Association shall consist of a President, two Vice-Presidents, and a Secretary, who shall also act as Treasurer.

SEC. 4. The officers shall be elected by ballot every two years.

SEC. 5. The management of the affairs of the Association shall be delegated to an Executive Committee, consisting of its President, Secretary, and three other members.

SEC. 6. One member of the Executive Committee shall be elected annually.

SEC. 7. The Association shall meet annually, the time and place to be determined by the Executive Committee.

SEC. 8. Candidates shall be proposed in writing to the Executive Committee by a member. Each proposal shall be made at or before the first session of any regular meeting of the Association. The proposal shall state the official position or occupation of the candidate and the character of his investigations. The election shall take place by ballot in open meeting, a two-thirds vote being necessary. Honorary members may be elected from those, not Americans, who have distinguished themselves in anatomical research.

SEC. 9. The annual dues shall be two dollars.

SEC. 10. The rulings of the Chairman shall be in accordance with "Robert's Rules of Order."

SEC. 11. Five members shall constitute a quorum for the transaction of business.

OFFICERS FOR THE YEAR 1891-'92.

DR. HARRISON ALLEN, of Philadelphia, President.
 DR. CHARLES HEITZMANN, of New York City, 1st Vice President.
 DR. THEODORE N. GILL, of Washington, D. C., 2d Vice President.
 DR. D. S. LAMB, of Washington, D. C., Secretary and Treasurer.

DELEGATE TO AMERICAN CONGRESS OF PHYSICIANS AND SURGEONS.

DR. F. J. SHEPHERD, of Montreal, Canada.

ALTERNATE.

DR. R. W. SHUFELDT, of Washington, D. C.

EXECUTIVE COMMITTEE.

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 DR. E. C. SPITZKA, of New York City, and the
 PRESIDENT and SECRETARY, *ex-officio*.

COMMITTEE ON ANATOMICAL NOMENCLATURE.

DR. HARRISON ALLEN, of Philadelphia.
 DR. FRANK BAKER, of Washington.
 DR. THOMAS DWIGHT, Harvard University.
 DR. THOS. B. STOWELL, of Potsdam, N. Y.
 DR. BURT G. WILDER, Cornell University, *Secretary*.

NOTICE.—The fifth (5th) annual meeting will be held at Princeton, N. J., December 27 to 29, 1892, at same time and place as the American Society of Naturalists.

PAPERS READ AT THE FOURTH SESSION.

WEDNESDAY, *Sept. 23, 1891.*

1. "The fundamental principles of anatomical nomenclature." Dr. Burt G. Wilder, Cornell University.
Read by title. Author and MSS. not present. Published in the *Medical News*, Philadelphia, December 19, 1891.
2. "The systematic use of the eye in teaching anatomy." Accompanied by a demonstration of a brain model. Dr. Wm. P. Carr, Washington, D. C.
This and the next two papers were discussed together by Drs. Baker, Heitzmann, Gerrish, Shepherd, Gill and Cunningham and the authors. Published in the *Medical News*, Philadelphia, Feb. 13, 1892, p. 179.
3. "Some impressions on the teaching of anatomy to medical students." Dr. Harrison Allen, Philadelphia, Pa.
Published in the *Medical News*, Philadelphia, Dec. 26, 1891.
4. "The study of anatomy from a physiological standpoint." Dr. Robert Reyburn, Washington, D. C.

THURSDAY, *Sept. 24th.*

5. "Recent fissural diagrams." Dr. Burt G. Wilder, Cornell University.
Read by title. Printed copies of the paper, illustrated, were distributed.
6. "The arrangement of the supracerebral veins in man, as bearing on Hill's theory of developmental rotation of the brain." Dr. Wm. Browning, Brooklyn, N. Y.
Discussed by Dr. Baker. Published in *New York Journal of Nervous and Mental Diseases*, November, 1891.
7. "The central, precentral and postcentral fissures of the human cerebrum." By invitation. Dr. D. J. Cunningham, Dublin, Ireland.
Discussed by Drs. Gill, Allen, Carr and Baker.
8. "Morphological importance of the membranous or other thin portions of the parietes of the encephalic cavities." Dr. Burt G. Wilder, Cornell University.
Read by Dr. Browning. Published in the *Journal of Comparative Neurology*, October, 1891.

9. "The alleged lateral communications of the fourth ventricle with the subarachnoid space. Are they natural?" Dr. Burt G. Wilder, Cornell University.

[Being a reply to part of Dr. F. W. Langdon's paper, "Homology of cerebrospinal arachnoid with the other serous membranes;" read at the Boston meeting in 1890, published in *Medical Record*, Aug. 15, 1891, p. 177.]
Read by Dr. Browning.

10. "The structure of basis and cement substance." Remarks and illustrations. Dr. Charles Heitzmann, New York City.

Discussed by Dr. Baker.

11. "Serial foetal sections." Specimens and remarks. Dr. W. M. Gray, Washington, D. C.

12. "The teeth of the Chiroptera." Remarks. Dr. Harrison Allen, Philadelphia, Pa.

13. "The metacarpus and its nomenclature." Remarks. By invitation. Dr. W. H. Pancoast, Philadelphia, Pa.

14. "Specimens of supernumerary digits in man and the pig." Remarks and specimens. Dr. F. J. Shepherd, Montreal.

The 13th and 14th contributions were then discussed by Drs. Baker, Carr and Allen.

FRIDAY, *Sept. 25th.*

15. "The relative frequency of the psoas parvus muscle in the colored race." Dr. E. A. Balloch, Washington, D. C.

Discussed by Drs. Baker, Allen, Lamb, West and Gerrish.

16. "Certain modifications in plant morphology, produced by external conditions." Dr. W. P. Wilson, Philadelphia, Pa.

Read by title. Author and MSS. not present.

17. "Comparative osteology of the North American pygopodes." Remarks and illustrations. Dr. R. W. Shufeldt, Washington, D. C.

18. "The supracondyloid process in man." With specimens. Dr. D. S. Lamb, Washington, D. C.

Discussed by Dr. Baker.

19. "Platycnemic tibias." Remarks and specimens. Dr. Frank Baker, Washington, D. C.

Discussed by Mr. Lucas.

20. "Origin and homologies of the chiropterygium." Dr. T. N. Gill, Washington, D. C.

Read by title. Author and MSS. not present.

21. "History of anatomy as a science." Dr. G. W. West, Washington, D. C.
22. "Congenital union of the quadrate jugal to the mandible in a cockatoo." Specimen and remarks. Mr. Fred. A. Lucas, Washington, D. C.
Discussed by Dr. Shufeldt.
23. "Homologies of the principal bones." Specimen and remarks. Mr. Fred. A. Lucas, Washington, D. C.
Discussed by Drs. Lamb and Baker.
24. "The fossa prænasis." Dr. Thomas Dwight, Harvard University.
Read by title. Author not present. MSS. not sent. Published in American Journal of the Medical Sciences, No. CIII, 1892, p. 156.
25. "Notes on the hearts of certain mammals." Illustrated by charts. Miss Ida Hyde, Chicago, Ill.
Read by title. Published in the American Naturalist, October, 1891.

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Massachusetts, . . .	7	Missouri, . . .	1
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Virginia, . . .	3	Minnesota, . . .	1
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Maine, . . .	2	Colorado, . . .	1
Louisiana, . . .	2	Arizona, . . .	1
Ohio, . . .	2	California, . . .	1
Michigan, . . .	2	Ireland, . . .	1

Total : 94 active, 1 honorary.

PROCEEDINGS
OF THE
FIFTH ANNUAL SESSION
OF THE
Association
of
American Anatomists,

Held at Princeton, N. J., December 27 to 29, 1892.

TO WHICH IS APPENDED A
LIST OF MEMBERS.

WASHINGTON, D. C.
GREENFORD, PRINTER, 617 E STREET.
1893.

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PROCEEDINGS OF THE FIFTH ANNUAL SESSION.

The fifth annual session of the Association was held December 27 to 29, 1892, in the School of Science Hall of the College of New Jersey, Princeton, N. J., President Allen presiding at the meetings. The following members were present at some time during the session:

Doctors Allen, Cope, Dwight, Gerrish, Haynes, Heitzmann, Herrick, Kemp, Lamb, Minot, Osborn, Piersol, Roberts, Ryder, Spitzka, Wortman, Wright.

The following extracts are taken from the report of the Secretary and Treasurer for the fifteen months from the fourth annual session, at Washington, D. C., September 23 to 25, 1891:

"The Proceedings of that meeting were duly printed and distributed. The distribution was not confined to the members of this Association, but was extended to include in all about 550 anatomists and biologists. In like manner programs of the present session were sent to the same addresses.

The amount in the treasury at the beginning of the fiscal year.....	\$192.12
Received from dues to date.....	130.10
Total.....	\$322.22
Expended to date.....	222.79
Remaining on hand.....	\$99.43

"The expenditures in detail were as follows:

For printing Report of Committee on Nomenclature.....	\$79.60
For printing Proceedings of Congress.....	53.94
For printing Proceedings for the same session.....	34.75
For printing circulars, programs, letter and envelope headings, and the stationery for the same..	17.50
For postage stamps, cards and wrappers.....	27.25
For small blank book for Executive Committee.....	25
For transcribing and typewriting.....	6.50
For express charges and fees to messenger and porter....	3.00

"It will be seen that the expenditure for the Report on Nomenclature and that for the Proceedings of the Congress amount to \$133.54, while the current expenses otherwise of the Association are but \$89.25, a little less than one dollar per member.

"The arrears for dues, at present, are \$100. One member owes for four years, 4 owe for three years, 4 for two years, and 24 for one year. I sent duplicate bills this month to delinquents. There is no provision in the Constitution for dropping names of delinquents. I think there should be. These gentlemen have had the benefit of the meetings of the Association, and have all been supplied with its publications; they do not offer their resignations, and, therefore, presumably desire to continue their membership. I think they should pay their dues or be dropped, with the right of restoration on paying arrears, other things being equal.

"The programs of this meeting were not printed sooner because of the late date of receipt of the titles of papers.

"The circular of inquiry in regard to the peculiarities of the negro race, which was recommended at the last session, and for which an expenditure of \$25 was authorized, was roughly formulated and circulated among the members of the Executive Committee for additions and modifications. On account of various delays, it is only just now in type."

The Auditing Committee, consisting of Drs. Dwight and Heitzmann, reported the accounts of the Treasurer correct.

The amendment to the Constitution offered by Dr. Allen at the fourth session and laid over till the fifth, and which provided that "An annual assessment shall be made to meet the expenses of the Association," was still further postponed till the next session.

The following new members were elected: Anderson, Birkett, Clark, Greenman, Hamann, Hartigan, Huntington, McCourt, Michel, Minot and Scott; total, 10 active, 1 honorary. (See list of members, page 15.)

The following report by Prof. Wilder, Secretary of the Committee on Nomenclature, was presented, and was referred to the Executive Committee:

"Second Preliminary Report of the Committee on Anatomical Nomenclature of the Association of American Anatomists.

"Other things being equal, we recommend the use of mononyms or single-word terms rather than polyonyms, terms consisting of two or more words.

"Note by the Secretary of the Committee:

"The above was adopted by the American Association for the Advancement of Science, in 1889; it is in harmony with the specific terms named in the report of this committee, which was adopted by the Association [of American Anatomists] in 1889.

"I think it may be well to postpone further formulation and specific recommendations until the Association passes upon the proposition enclosed herewith. (Signed) BURT G. WILDER.

"WHEREAS, The subject of *Morphological Nomenclature*, botanical as well as zoölogical, is now under consideration by many biologists individually and as members of committees, and

"WHEREAS, In the first Report of the Committee on Biological Nomenclature, unanimously adopted by the American Association for the Advancement of Science, August 22-23, 1892, the article *Anatomical Terminology*, in the 8th vol. of Wood's 'Reference Handbook of the Medical Sciences,' by B. G. Wilder and S. H. Gage, is characterized as 'representing an epitome of the whole subject, with suggestions for future progress,' and

"WHEREAS, Said article, even when accessible to biologists, is not in a form convenient for reference; therefore,

"Resolved, 1. If, with the assent of the junior author of said article and of the publishers of the 'Handbook,' the senior author shall, within the coming year, edit and publish said article, together with notes and comments by himself and others, especially members of this Association, to whom proofs may have been submitted, as an octavo volume of not less than 100 pages of about 350 words per page, then this Association agrees to take 500 copies, in paper covers, and to pay therefor \$125, being at the rate of 25 cents per copy: *Provided*, That every copy, whether taken by the Association or disposed of by the editor, contain the following paragraph:

"The Association of American Anatomists has contributed toward the republication of the article *Anatomical Terminology* from the "Reference Handbook" in order that it may be more generally available in the discussion of the subject; but the Association does not thereby commit itself to any opinion respecting the principles or terms therein advocated, excepting so far as included in its own reports.'

"2. The 500 copies taken by the Association shall be distributed as follows :

"a. To each member of the Association, two copies ;

"b. To each of the present officers, five copies ;

"c. The remainder, excepting a reserve of twenty-five copies in the keeping of the Secretary of the Association, to be assigned, according to his discretion, to the members of other committees on the subject, to appropriate journals and to libraries, medical, scientific and public.

"The foregoing is recommended by the following members of the Committee on Anatomical Nomenclature :

"(Signed) BURT G. WILDER, *Sec'y*.

"Princeton, N. J., Dec. 27, 1892."

Dr. F. H. Gerrish, of Portland, Me., was elected a member of the Executive Committee in place of Prof. Wilder, whose term, by the Constitution, expired at this session.

The following papers were read: (See page 11.)

The address of President Allen, of the Association, was delivered on Wednesday, December 28th.

The paper of Dr. Duncan (see page 12), "Note on Diagrams of the Spinal Cord," was referred to the Committee on Nomenclature.

The papers of Drs. Balloch and Gerrish on "Delimitation of the Abdominal Regions" were ordered, with the consent of the authors, to be collated with the discussion, and copies sent to the Anatomical Societies of Great Britain and Germany.

A reception was given on the evening of Tuesday, December 27th, by President and Mrs. Patton, of Princeton College, at their residence, "Prospect," to the members of the American Society

of Naturalists, the American Physiological Society, the Society of Morphologists, and Association of American Anatomists Previous to the reception, Dr. C. Hart Merriam, of the Department of Agriculture, Washington, D. C., delivered a lecture before the societies in the old Nassau Hall (built in 1756). His subject was "The Death Valley Expedition," and was illustrated by maps and charts.

The formal address of welcome by President Patton was given before the societies on Wednesday, December 28, at 2 P. M.

On Wednesday night, at 8 o'clock, there was a banquet in University Hall, attended by the members of the societies, at which Prof. H. F. Osborn, President of the American Society of Naturalists and also a member of this Association, delivered his annual address.

An abstract of the Proceedings of this session was published in the *Medical News*, Philadelphia, January 28, 1893, page 109. An abstract was also published in the *American Naturalist*, March, 1893, page 308, and in *Science*, January 20, 1893, page 35.

During the session, reports were published daily in the *New York Times*.

The President was directed to return the thanks of the Association to the members of the Committee of Arrangements, and, through this committee, to the college authorities, for the use of the place of meeting and for attentions received ; and especially to Prof. Macloskie for his kind assistance in the work of the Association. (This Committee of arrangements consisted of Professors Wm. Libbey, Jr., George Macloskie and Wm. B. Scott, of Princeton College.)

The thanks of the Association were also tendered to the President and Secretary.

Dr. Wm. T. Councilman, late of Johns Hopkins University, Baltimore, now of Harvard Medical School, has resigned his membership.

Dr. William Lee, of the Medical Department of Columbian University, Washington, died March 2, 1893.

CONSTITUTION.

SECTION 1. The name of the society shall be the "Association of American Anatomists."

SEC. 2. The Association shall have for its object the advancement of the anatomical sciences.

SEC. 3. The officers of the Association shall consist of a President, two Vice-Presidents, and a Secretary, who shall also act as Treasurer.

SEC. 4. The officers shall be elected by ballot every two years.

SEC. 5. The management of the affairs of the Association shall be delegated to an Executive Committee, consisting of its President, Secretary, and three other members.

SEC. 6. One member of the Executive Committee shall be elected annually.

SEC. 7. The Association shall meet annually, the time and place to be determined by the Executive Committee.

SEC. 8. Candidates shall be proposed in writing to the Executive Committee by a member. Each proposal shall be made at or before the first session of any regular meeting of the Association. The proposal shall state the official position or occupation of the candidate and the character of his investigations. The election shall take place by ballot in open meeting, a two-thirds vote being necessary. Honorary members may be elected from those, not Americans, who have distinguished themselves in anatomical research.

SEC. 9. The annual dues shall be two dollars.

SEC. 10. The rulings of the Chairman shall be in accordance with "Robert's Rules of Order."

SEC. 11. Five members shall constitute a quorum for the transaction of business.

OFFICERS FOR THE YEAR 1892-'93.

DR. HARRISON ALLEN, of Philadelphia, President.
 DR. CHARLES HEITZMANN, of New York City, 1st Vice President.
 DR. THEODORE N. GILL, of Washington, D. C., 2d Vice President.
 DR. D. S. LAMB, of Washington, D. C., Secretary and Treasurer.

DELEGATE TO AMERICAN CONGRESS OF PHYSICIANS AND SURGEONS.

DR. F. J. SHEPHERD, of Montreal, Canada.

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DR. R. W. SHUFELDT, of Washington, D. C.

EXECUTIVE COMMITTEE.

DR. THOMAS DWIGHT, of Harvard University.
 DR. E. C. SPITZKA, of New York City.
 DR. F. H. GERRISH, of Bowdoin College, and the
 PRESIDENT and SECRETARY, *ex-officio*.

COMMITTEE ON ANATOMICAL NOMENCLATURE.

DR. HARRISON ALLEN, of Philadelphia.
 DR. FRANK BAKER, of Washington.
 DR. THOMAS DWIGHT, of Harvard University.
 DR. THOS. B. STOWELL, of Potsdam, N. Y.
 DR. BURT G. WILDER, of Cornell University, *Secretary*.

PAPERS READ AT THE FIFTH SESSION.

1. "Crania of the Cetacea." Dr. Harrison Allen, University of Pennsylvania.
Not to be published.
2. "The human lower jaw." Dr. Allen.
Not to be published. Both of these papers were illustrated by specimens, and were discussed by Prof. Herrick and by Prof. Geo. Macloskie, of Princeton College.
3. "History of the development of bone tissue." Illustrated by microscopical slides. Dr. Carl Heitzmann, New York City.
Discussed by Profs. Macloskie and William Libbey, Jr., Princeton College. Not to be published.
4. Address of the President, Dr. Allen.
5. "An anomalous development of the human sternum." Specimen and remarks by Dr. D. S. Lamb, Army Medical Museum, Washington, D. C.
Discussed by Dr. Dwight. To be published.
6. "Discovery of an ossified thyroid cartilage and a supposed rudimentary clavicle in an Artiodactyl." With specimen. Prof. Wm. B. Scott, Princeton College.
Discussed by Prof. Cope and Dr. Allen. To be published.
7. "Observations on the psoas parvus and pyramidalis. A study of variation." Dr. Thomas Dwight, Harvard Medical School.
Published in the Proceedings of the American Philosophical Society, 1893, page 117.
8. "Significance of percentages in human anatomy." Prof. H. F. Osborn, Columbia College, New York City.
Discussed by Prof. Cope and Drs. Dwight and Lamb. To be published.
9. "Histology and physiology of the nervous elements." Prof. C. L. Herrick, Denison College, Granville, Ohio.
Discussed by Drs. Heitzmann and Piersol. Published in the Journal of Comparative Neurology, December, 1892, page 137.

10. "The metapore or foramen of Magendie." With photographs. Prof. B. G. Wilder, Cornell University.
In the absence of Prof. Wilder, the paper was read by Prof. Clark. Discussed by Prof. Herrick. Published in Reference Handbook of Medical Sciences, supplementary volume, 1893. Abstract in New York Medical Record, 1893.
11. "Embryological notes on the brain of the snake." Prof. Herrick.
Published in Journal of Comparative Neurology, December, 1892, page 160.
12. "The insula of the pig." With specimens. Prof. Tracy E. Clark, B. S., Clinton Liberal Institute, Fort Plain, N. Y.
Discussed by Drs. Allen, Dwight and Spitzka. Published in Journal of Comparative Neurology, March, 1893, page 7.
13. "Note on diagrams of the spinal cord." Dr. J. T. Duncan, Woman's Medical College, Toronto, Canada.
Read by the Secretary, and referred to the Committee on Nomenclature.
14. "Duration of motion of human spermatozoa." Dr. Geo. Piersol, University of Pennsylvania.
Discussed by Drs. Spitzka and Heitzmann. Published in Anatomischer Anzeiger, Nos. 8 and 9, Bd. VIII, 1893, pages 299 to 301.
15. "The innervation of the organ of Corti." Microscopical slides, with remarks. Howard Ayers, Ph. D., Director of Lake Laboratory, Milwaukee, Wis.
Published in Anatomischer Anzeiger, 1893, Vol. VIII, Nos. 10 and 11, pages 435 to 440, in abstract; the full paper will appear in the Journal of Morphology.
16. "The posterior surface of the liver; described by Vesalius." Dr. F. H. Gerrish, Bowdoin College, Maine.
Discussed by Drs. Dwight, Allen and Heitzmann. To be published.
17. "Embryos of bats." With specimens and plates. Dr. Allen.
Discussed by Profs. Cope and C. S. Minot. Not to be published.
18. "The Meckel diverticulum." Dr. Lamb.
Discussed by Drs. Dwight and Minot. Published in American Journal of Medical Sciences, June, 1893.
19. "Delimitation of abdominal regions." Dr. E. A. Balloch, Howard University, Washington, D. C.
Read by the Secretary.
20. "The need of agreement on the limits of the abdominal regions." Dr. Gerrish.
The last two papers were discussed by Drs. Dwight, Piersol, Kemp, Heitzmann and Lamb.
Several motions were made in regard to the disposition of these two papers and the discussion thereon. It was finally decided that, with the consent of the authors, copies should be sent to the Committee of the Anatomical Society of

Great Britain and Ireland on the same subject, and also to the Committee of the German Society. Papers and discussion published in the Boston Medical and Surgical Journal, 1893, page —.

21. "Physical characteristics of the Kootenay Indians of South-eastern British Columbia." Prof. Alex. F. Chamberlain, Clark University, Worcester, Mass.

Read by title. Published in the Eighth Report on the Northwestern Tribes of Canada, British Association for the Advancement of Science, Edinburgh Meeting, 1892, pages 38 to 45.

22. Series of thirty-five natural size photographs of sections of human brain, with brief remarks. Dr. I. S. Haynes, University of New York.

Not to be published.

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- Stowell, Thomas B., A. M., Ph. D. Potsdam, N. Y.
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- Williston, Samuel W., A. M., Ph. D., M. D. Lawrence, Kan.
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Wortman, Jacob L., M. D. New York City.

American Museum of Natural History, Central Park, New York City.

Wright, R. Ramsey, M. D. 603 Spadina ave., Toronto, Can.

Professor of Biology, University of Toronto.

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Illinois, . . . 5	Iowa, . . . 1
Canada, . . . 4	Missouri, . . . 1
Virginia, . . . 3	Wisconsin, . . . 1
United States Army, . . 3	Kansas, . . . 1
Maine, . . . 2	Colorado, . . . 1
Connecticut, . . . 2	Arizona, . . . 1
Louisiana, . . . 2	California, . . . 1
Ohio, . . . 2	Oregon, . . . 1
Michigan, . . . 2	Ireland, . . . 1
Minnesota, . . . 2	England, . . . 1

Total: 102 active, 2 honorary.

PROCEEDINGS
OF THE
SIXTH ANNUAL SESSION
OF THE
Association
of
American Anatomists,

Held at Washington, D. C., May 29 to June 1, 1894,

TO WHICH IS APPENDED A

LIST OF MEMBERS.



WASHINGTON, D. C.
BERESFORD, PRINTER, 617 E STREET.
1894.

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PROCEEDINGS OF THE SIXTH ANNUAL SESSION.

The sixth annual session of the Association was held May 29th to June 1st, 1894, in the Preparatory Department of the Columbian University, H Street between Thirteenth and Fourteenth, N. W., Washington, D. C. The meeting was in conjunction with that of the Congress of American Physicians and Surgeons.

The following officers and members were present :

Dr. Allen, President; Drs. Heitzmann and Gill, the Vice-Presidents; Dr. Lamb, Secretary and Treasurer; Drs. Dwight and Gerrish, of the Executive Committee, and Dr. Shufeldt, Delegate to the Congress; and Drs. Baker, Balloch, Browning, Carr, Ferris, Hamilton and Hewson, Mr. Lucas, Drs. Mears and Mixer, Mr. Moody, Drs. Moody, Moran, Reyburn, Richardson, Shute, Souchon and Wilder.

The following extracts are taken from the report of the Secretary and Treasurer for the seventeen months which had elapsed since the fifth annual session at Princeton, New Jersey, December 27 to 29, 1892:

"The sixth regular meeting of the Association should have been held in December, 1893, but, in view of the Pan American Medical Congress in Washington, September 5th to 8th, 1893, and the present meeting taking place in May, instead of September, as was anticipated, the Executive Committee decided that a December meeting would be in too close proximity to the others to be successful, and accordingly deferred the meeting to the present time."

"Since the last meeting, three members have died, and two have resigned. * * * Dr. Wm. Lee, Professor of Physiology, Medical Department Columbian University, Washington, D. C., died March 2, 1893. Dr. Wm. B. Towles, Professor of

Anatomy and Materia Medica, University of Virginia, and Professor of Anatomy, University of Vermont, died September 16, 1893. Dr. Corydon L. Ford, Professor of Anatomy and Physiology, University of Michigan, died April 14, 1894. Dr. Ford was the author of a number of small works on Anatomy, Histology and Physiology for the use of students. Dr. Chas. B. Ewing, Assistant Surgeon, U. S. A., and Dr. F. C. Schaefer, Professor of Anatomy, Chicago Medical College, have resigned.

"Since the last meeting I have collated about 650 names of persons living in the United States and Canada, who are particularly interested in Anatomy. Somewhat over three hundred of this number are professors or demonstrators in medical colleges. Adding our own membership, increases the number to about 750.

"The financial statement is as follows :

Balance on hand, Dec. 27, 1892,	\$99.43
Received from dues,	158.10
" " sundries,	22.00
	<hr/>
Total,	\$279.53

Expended.

For printing and stationery,	\$87.74
" postage and express,	28.28
" typewriting and copying,	12.75
" sundries,	3.96
	<hr/>
	\$132.73
Remaining on hand, May 29, 1894,	\$146.80

The arrears for dues amount to \$140.00. Twenty-five members have failed to pay for *one* year; eight members for *two* years; four for *three* years; three for *four* years; and one for *five* years."

The Auditing Committee, consisting of Mr. Lucas and Dr. Souchon, reported that the accounts of the Treasurer were correct.

Dr. Wilder, Secretary of the Committee on Anatomical Nomenclature, reported progress.

The following new members were elected: Boger, Ferris, Greene, Keiller, Leidy, M. B. Moody, R. O. Moody, Smith, Stillman, Turner, Woodward; total eleven, of whom one is honorary. (See list of members, page 56.)

The following papers were read, and remarks made. (See page 9.)

The amendment to the Constitution offered by Dr. Allen at the fourth session, laid over to the fifth and then to the sixth, and providing that, "An annual assessment shall be made to meet the expenses of the Association," was withdrawn.

The following amendment to the Constitution, section 9, was adopted: "A member in arrears for dues for two years shall be dropped by the Secretary at the next succeeding meeting of the Association, but may be restored on payment of arrears, at the discretion of the Executive Committee."

The Executive Committee recommended that members and others who read papers or make remarks, including discussions, be requested to furnish abstracts of the same to the Secretary to be published with the Proceedings.

The terms of office of the President, Vice Presidents, Secretary and Treasurer, Delegates to the Congress, and one member of the Executive Committee having expired, the following were elected to fill the vacancies. (See page 8.)

A committee of three was appointed, consisting of Drs. Mears, Bryant and Dwight, to consider the question of the collection and preservation of anatomical material, and to report at the next meeting what, in their opinion, is the best means of accomplishing these objects.

The Executive Committee referred the preparation of the circular and blanks in regard to the Anatomical Peculiarities of the Negro, to a committee of three, consisting of Drs. Lamb, Baker and Shute, to report, if possible, by the next meeting.

A reception was given by the President of the United States and Mrs. Cleveland, to the Congress of which this Association is a part, on Thursday, May 31st, from 9 to 10 P. M.

The address of the President of the Congress, Dr. Alfred L. Loomis, of New York City, on "The Influence of Animal Ex-

perimentation on Medical Science," was delivered the same evening at 7.30 o'clock.

The general session of the Congress, on the afternoon of May 29th, was under the direction of this Association. The subject of discussion was "Morphology as a Factor in the Study of Disease." The discussion was opened with a paper by Dr. Allen, and continued by Drs. Dwight, Baker and Wilder. These papers will be published in the Proceedings of the Congress.

The Cosmos Club extended its hospitalities to the members of the Association during the session.

An abstract of the Proceedings of the Association was published in the "Medical News" of Philadelphia, June 23, 1894, p. 707.

Dr. Middleton Michel, Charleston, S. C., Professor of Physiology, Medical College of South Carolina, died June, 4th.

CONSTITUTION.

SECTION 1. The name of the society shall be the "Association of American Anatomists."

SEC. 2. The Association shall have for its object the advancement of the anatomical sciences.

SEC. 3. The officers of the Association shall consist of a President, two Vice Presidents and a Secretary, who shall also act as Treasurer.

SEC. 4. The officers shall be elected by ballot every two years.

SEC. 5. The management of the affairs of the Association shall be delegated to an Executive Committee, consisting of its President, Secretary and three other members.

SEC. 6. One member of the Executive Committee shall be elected annually.

SEC. 7. The Association shall meet annually, the time and place to be determined by the Executive Committee.

SEC. 8. Candidates shall be proposed in writing to the Executive Committee by a member. Each proposal shall be made at or before the first session of any regular meeting of the Association. The proposal shall state the official position or occupation of the candidate and the character of his investigations. The election shall take place by ballot in open meeting, a two-thirds vote being necessary. Honorary members may be elected from those, not Americans, who have distinguished themselves in anatomical research.

SEC. 9. The annual dues shall be two dollars. A member in arrears for dues for two years shall be dropped by the Secretary at the next succeeding meeting of the Association, but may be restored on payment of arrears, at the discretion of the Executive Committee.

SEC. 10. The rulings of the Chairman shall be in accordance with "Robert's Rules of Order."

SEC. 11. Five members shall constitute a quorum for the transaction of business.

OFFICERS FOR THE YEARS 1893-'94.

DR. THOMAS DWIGHT, of Boston, Mass., - - - - President.
 DR. B. G. WILDER, of Ithaca, N. Y., - - - - 1st Vice President.
 DR. F. J. SHEPHERD, of Montreal, Canada, - - - - 2d Vice President.
 DR. D. S. LAMB, of Washington, D. C., - - - - Secretary and Treasurer.

*DELEGATE TO AMERICAN CONGRESS OF PHYSICIANS AND
 SURGEONS.*

PROF. C. L. HERRICK, of Granville, Ohio.

ALTERNATE.

DR. D. K. SHUTE, of Washington, D. C.

EXECUTIVE COMMITTEE.

DR. E. C. SPITZKA, of New York City.
 DR. F. H. GERRISH, of Portland, Me.
 DR. THEODORE N. GILL, of Washington, D. C.
and the
 PRESIDENT and SECRETARY, *ex officio*.

COMMITTEE ON ANATOMICAL NOMENCLATURE.

DR. HARRISON ALLEN, of Philadelphia.
 DR. FRANK BAKER, of Washington.
 DR. THOMAS DWIGHT, of Boston.
 DR. THOMAS B. STOWELL, of Potsdam, N. Y.
 DR. BURT G. WILDER, of Ithaca, *Secretary*.

PAPERS READ AT THE SIXTH SESSION.

*"MORPHOLOGY AS A FACTOR IN THE STUDY OF DISEASE." READ BEFORE THE CONGRESS OF AMERICAN PHYSICIANS AND SURGEONS AS THE SPECIAL PAPER OF THE GENERAL SESSION OF THE AFTERNOON OF TUESDAY, MAY 29TH, BY DR. HARRISON ALLEN, PROF. COMPARATIVE ANATOMY, UNIV. PENNSYLVANIA.

The anatomist who stands on the vantage-ground of medicine is often told that by the cultivation of the last four hundred years his subject is finished—that no new thing can be said of it. Whether or not the human anatomist is to be congratulated, being thus identified, is a matter of opinion. For my part, I venture the statement that no true anatomist would be content for a moment with a science thus limited. Were he so to accept it his energies would be necessarily confined to acquiring what his predecessors had secured in an equal degree. I am sure I represent my fellow-workers when I say that the science of anatomy is awaiting important advances.

I confess to a feeling of impatience that the science of anatomy is still commonly taught pretty much as it was a century ago, and I cannot refrain from expressions of regret that these methods have not undergone change, even in the centers which have witnessed important revolutions in other departments. The demands of the surgeon still dominate the lecture hall. No fact that cannot be used in the clinical amphitheater is thought to possess value; the forces for the education of the medical thinker and scholar are unused; the powers of observation of the practicing physician are not stimulated; the outlines of method by which the science of morphology can be extended by experiments are unthought of, while the opportunities of accumulating at the hands of the physician materials to be used in the explanation of phenomena of organic structure acting perversely, or serving as the causes of diseased action, are neglected.†

* The paper of Dr. Allen on Morphology, and the discussions upon the same by Drs. Dwight, Baker, Wilder and Allen, are republished by permission, from the Transactions of the Congress of American Physicians and Surgeons, Vol. III, 1894. Dr. Allen has omitted some paragraphs in this publication, which appear in the transactions of the Congress.

† Philadelphia: P. Blakiston, Son & Co., 1887, p. 116.

It is true that these and similar facts are in the possession of advanced clinical workers, but they often appear under heads not suggestive of their exact position in knowledge. Many important considerations are scattered through hospital reports, treatises on practice, or the transactions of pathological societies. Sometimes they are veiled under misleading titles. The actions of muscles have been held to be always corollaries of the descriptions of the muscles themselves; indeed, to be logical deductions from the formulæ of their origins, insertions and nerve supply. Yet these facts are wrested from anatomy under the name of physiology of movements. Such a classification would bear to physiology the relations which obtain between the structure of bone and the dynamics of the skeleton, the studies of the eruption and succession of the teeth and the rates of growth of organs. Teratology is generally cultivated by obstetricians, and, if students of medicine were taught this subject, it is as likely as not that it would be undertaken by the chair of obstetrics, and thus a purely morphological series of demonstrations be not credited to the department of anatomy.

It is evident that physicians who become interested in these and allied subjects obtain their knowledge, so far as it relates to the elucidation of medical problems, after their academic education is completed. Is it not entirely proper that they should be carefully instructed in them before graduation? Is it not patent that the difference between the imperfectly educated and the accomplished physician can be determined by the use of the test of being able to interpret morphological factors in the study of disease as well as by any other test of efficiency?

It is acknowledged that chemical conditions underlie texture, and it is a matter to be regretted that the morphologist gains so little by this association of truths. Not, indeed, that the knowledge of chemical changes in tissue does not enter into his problems. He is well aware of the close connection between the chemical composition of teeth and their forms, of the great influence that the beginnings of calcification of the triangular cartilage of the nasal septum exert over the shapes of the nasal septum, as well as the immense range of changes initiated in gouty and rheumatic conditions. Exact relations are shown to exist between the chemical constitution of the fluids and the shapes of some of the organs. These changes, it is true, are often unimportant to the individual, are peripheral, and apparently of no special significance. But the general shape of the gouty tooth is, so far as it goes, distinctive, as also is the fact that the lower incisor teeth are altered slightly in their relations one to another.

If among wild animals varieties were found to vary as much among themselves as do gouty and non-gouty persons, zoölogists would be justified in defining therefrom subspecies. Why should not gout be defined as well by the results of the chemical compositions of the fluids as by these compositions themselves? Indeed biological science teaches us that morphological data are the most reliable, and it were better to define gout and rheumatism by the peripheral characters, even if we do not derive therefrom any notable practical advantage.

So long as we study diseases, as distinguished from their causes and effects, we are empirical. We hear much of the "science of medicine." Surely it is a "so-called" science when it deals only with clinical phenomena. No medical center which is dominated by a clinical element (I am anxious here to recall that by clinical work is meant literally the bedside work, or its equivalent), the study of the patient rather than the causes which evolved the patient (or the possible study of the body of the patient, if he should be so unfortunate as to die), can be said to be an empirical one, and history shows it to be singularly liable to be clouded by speculative opinion. I respectfully submit that the theories of the humorists, the solidists, or any one of the many theories which have agitated the profession (the hosts of spectral forms that surge up to the line of blood in the limbo of medical philosophy), would have been impossible had the system of medicine been broadly based upon morphological data. But such a basis was not feasible until the organic sciences were themselves formulated. The great reputation of Boerhaave rests upon his recognition of chemical and anatomical data as aids to the study of medicine. The amount of anatomical reading he recommended his pupils showed a knowledge of anatomy which has probably never been approached by any of the authorities in clinical medicine since his day.

The changes in the shape and composition and use of a part of an organism constitute a variation—that is to say, an exception to a rule which has been formulated concerning their shape, composition, or use. The detection of these variations, and the propositions upon which they are based, constitute one of the chief occupations of the morphologists.

The difficulty of proving the value of minute knowledge of the muscle-fibers of the body is very great, for anatomists so rarely have an opportunity of making the necessary demonstrations. Let me illustrate a few of the very probable etiological factors in such conditions as esophageal pouch and heart-failure. Esophageal pouch is a yielding of the muscle-wall of the pharynx

as it joins the esophagus in individuals who possess an insufficient number of the circular fibers of the lower pharynx or the beginning of the esophagus, which will in rare instances have developed an invagination of mucous membrane at the line of fault. This is a simple example of the manner by which a minute anatomic variation may become a factor in the etiology of disease. It is well known that the staying power of athletes relates more to minute inherited peculiarities in the heart than to any other group of conditions. Let a number of men subject themselves to the same physical test—it may be a walking-match or a swimming-match—it will be found, (all things remaining equal) that the man with the best heart carries the day. May we not suppose that such a heart had an exceptionally firm closure of the foramen ovale and the ductus arteriosus? That it possessed powerful chordæ tendineæ? That the pulmonary artery was free from the slightest degree of stenosis? What is true of the heart is true of the muscles of the limbs. The differences that serve to mark the musculature of the mammalia are often minute, and not of necessity of the same functional importance as those of larger size, yet doubtless have significance in adapting the animal to special conditions of environment.

In an exact sense, the structure of an animal may be said to express the resultants of certain forces. In a sense, the work of the anatomist can be said to be that of analyzing the results of these forces.

In a general way the variations themselves are held to be the results of a few all-pervading forces (as a rule nutrition modified in some way from what is ordinarily met with, plus the trend of heredity), and these are inscribed in the body as dynamic energies may be recorded on a kymographion. But how inadequate such a record becomes is evident when we study any of these factors by the standard of the gross changes excited by disease. Disease in a morphological sense is the expression of forces operating inordinately or eccentrically. Yet how completely our systems fail when we attempt to explain them by the tests of nutrition or of heredity! So when the anatomist is told that his science to a great degree is one of record and not of thought, the answer may be given, properly enough, we think, that the reason lies in the inadequacy of knowledge of the causes of which structures are simply the effects. If the general clinical observer will give the anatomist more data as to the causes of congenital idiocy, the anatomist will be able better to explain the appearances he notes in the dissection of the idiot. If the ethnologist will explain the meanings of the divergences and

contrasts of race, the anatomist will give a more philosophical description than is now possible of the differences between the structure of a Hottentot and that of a Northern European.

Sir James Paget has lately urged the examination of varieties in different examples of the same disease after the manner of accurate botanists and zoölogists, by the observation and record of the larger external characters and indications in the human body. Among the special subjects outlined he names the following: 1st. Varieties of diseases usually regarded as species, and so arranged in nosologies; 2d. The effect of mingling of diseases by hereditary transmission or otherwise.

While the method is certainly a gain over accepted clinical methods, we venture to assert that the study of etiology is not satisfactory without experimentation. Jenner tells us that John Hunter was in the habit of saying to his pupils "Do not think: try." If we are not careful we may be misled as to the meaning of this saying. We all know that Hunter was always thinking and trying. His dictum is paradoxical unless it be thus read: "Do not stop at the thought; try the thought by the test of observation or experiment."

A zoölogical station is a place where experiments are conducted in the study of the structure and relations of animals. An anatomical station must be the same if anatomy is to take its place among the progressive biological sciences. Observation has been shown to be insufficient to interpret natural processes. We can observe the effects of an experiment of nature; we can imitate such an experiment; but we cannot ignore the method by which effects are produced. Bates discovered in the Valley of the Amazon the exact conditions under which a given species of butterfly existed, so that in studying its varieties he may be said to have witnessed the creation of a new species. Every thriving organism can be said to be a result of Nature's successes in her experiments, every languishing one a result of her failures.

Let me, in conclusion, call your attention to a subject which, while resting on biological tenets, is of professional interest. It is that the anatomical material coming under our notice is almost always that of a highly domesticated,* or, as one may say, over-

* The use of the word "domesticated" in this sense needs explanation. The Century Dictionary gives the following phrase as a definition of "to domesticate": "To reclaim from a state of nature." It also gives the following: "To convert to domestic use, as wild animals or plants." I have used the word in the sense first given. Man is "reclaimed from a state of nature"; i. e., he is not available as an absolutely feral subject. But he is not domesticated as dogs and horses are, since, as Darwin (*Descent of Man*, i, 112) expresses it, man "differs widely from any strictly

acclimated nature, and that in order to study it with advantage we must recall what is in common between man and the animals (both in a wild and a domesticated state) about him. Not that savage man is of necessity a primitive man; he is often a degraded, a degenerate man. The ranges of anatomical structure are on that account all the more interesting. The human anatomist should hold to the hypothesis that studies in degeneration are really studies of a character so closely allied to those that are morbid that the distinction in a system of knowledge cannot be made. Our acquaintance with man as a domesticated animal, as a degenerate animal, and our ignorance of him as a wild and primitive animal, cause the morphologist to regard human structures with the same sort of interest that the botanist entertains for those plants which have been cultivated so long that he has lost knowledge of the typical form of the species. Man has doubtless undergone changes in his organization precisely like those which exist in a domesticated animal when his organization is compared to that of an ancestral form. Can the anatomy of such an animal be said to be closed? Should we not rather humbly acknowledge that we know little of a subject at once so vast and so difficult?

While degeneration is a phase of a specialization it is one portraying structures that fail to subserve the highest possible use in the economy, certainly a degree of efficiency lower than that seen in similar structures in animals in a wild state. Palæontology teaches us that the earlier types of horses possessed short crowns to the molar teeth, while recent horses have long crowns. These bear to one another a relation quite the same as that discernible in the teeth of man. The best molar type in the human subject exhibits long crowns, while the worst is one in which the crowns are short, and, indeed, often scarcely protrude from the gums. The terms brachidontism and hypsodontism have been proposed to express these conditions, and we can say that while brachidontism is a sign of an early phase of variation in the horse, it is a sign of late phase in man; that in the horse it subserves a relation to the phylogeny of the zoological group to which the horse belongs, while in man it is a sign of degeneracy due to intricate causes, prominent among which lie the profound de-

domesticated animal, for his breeding has not been controlled either through methodical or unconscious selection." The effects of living in crowds, on unwholesome food, for numbers of generations, may not be those of domestication; neither are they of a kind comparable to those met with in the wild animal. The essential point I wish to make is this, that many morphological details result from self-imposed restraint, and that these details are to be treated in a manner somewhat the same as when met with in the process of changing a wild animal or plant into a domestic one."

pression of vitality arising from inherited struma, tuberculosis, syphilis, or to one or more of these conditions in combination.

In like manner the phenomena of polycuspidation in the molars relate to the evolution of the group to which a given animal belongs, and the cuspidation may be lost in the attempt to adapt the form to functions of defense. Yet if in the human molar the cusps show a disposition to recede from the quadritubercular to the tritubercular type, the result is a loss to all the previous gain. Nothing good is to be expected to accrue to the individual in which they occur. In the human dental series they are very frequently seen. We can say with certainty that the loss of a cusp in a human molar tooth is associated with decreased initial energy; and that these changes are not due, as in the case in the lower animals, to adaptation to special, and, as a rule, to higher ends.

The same remarks would apply to the proportionate size of the face as compared with that of the brain-case. The long-faced ant-eater is separated by family lines only from the short-faced sloth, and these distinctions have been brought about by the law of natural selection. But the short-faced specimens of the skull of civilized men are the results not of such a law but of the recedence from positions of high specialization secured by the operation of that law. They have tumbled from a lofty position by some profound impression on nutritive forces rather than reverted. Hence they come within the range of degenerated structures.

To what extent structures which are degenerate become on that account predisposed to disease it is difficult to say. But no difficulty exists in obtaining consent to the statement that, taken as a whole the animal economy resists the inroads of disease in proportion as its vitalities are maintained at high levels of efficiency. It is tenable, therefore, that the different parts of the economy which resist disease are also those which are richly endowed with all the essentials of well-being. This line of thought is sustained by my own clinical studies in the diseases of the nasal chamber. Many of the exceedingly numerous variations in the shapes of the nasal chambers are examples of degenerated structures, that is to say they are degraded expressions of anatomical form due to or at least associated with a facial region which is stunted and dwarfed. If such a premise be conceded, then the next thought to my mind is logical, namely, that such structures are of necessity liable to become diseased.

We may assert without fear of contradiction that the skeleton of civilized man in like manner differs from the skeleton

of uncivilized man. By civilized man in this connection I mean man as we find him to be in the great centers of population, past or present, where for acknowledged periods of unknown duration he has lived in communities having attained high grades of social organization, such as the people of modern Europe, (of America so far as this continent is settled from Europe) and of ancient Peru. Doubtless Asiatic centers must be added to those enumerated. Yet of these, material for study is wanting. If I may be permitted to say in a few words what impresses me most in a series of skulls of civilized centers, it is the absence of correlation; that is to say, I find the disposition usually present in crania of wilder types of man for one part of the skull to be in harmony with another part to be largely absent. The bones themselves appear to be individualized. Let me mention some of these. The occipital bone tends to project between the lambda and the inion. The malar bone tends to elongate vertically, so that the orbit is relatively large; the ethmoid bone to extend less into the nasal chamber, so that when the middle turbinated bones are sought for in the living subject they are found to be lodged high above the plane of nostrils, and their lower borders are often oblique in position instead of horizontal. The roots of the upper molar teeth tend to be confluent, and the crowns to be elliptical in shape instead of quadrangular. Yet not infrequently a small, square orbit may be associated with an elongated jaw, or a short, set jaw with a wide, ovoid orbit.

Perhaps the best single conclusion to be drawn from the study of morphology as a factor in the study of disease is its value to humanity. The scientific study of race in connection with diseased action is almost an unbroken field. When this comparative phase of anatomy shall have been formulated we shall for the first time have a reasonable hope that the subject of human acclimatization, the geographical study of diseases, the causes and motives of migration, and thus indirectly, the history and destiny of man himself may be in shape for elucidation.

[Since the foregoing address was written my attention has been called to a paper read by M. de Giovanni on "The Morphological Examination of the Individual," an address delivered before the late International Congress at Rome. I have also received from Prof. Wilhelm Roux, of Innsbruck, a prospectus of a new publication, entitled *Archiv für Entwicklungsmechanik der Organismen*. This journal will serve as a vehicle for the expression of views much the same as those held in the foregoing address. It would seem, therefore, that the subject of morphology, especially in relation to clinical and pathological conditions, is already attracting attention.]

The preceding paper of Dr. Allen was first discussed by Dr. Thomas Dwight, of the Harvard Medical School, in the following paper :

Mr. PRESIDENT : Dr. Allen defines morphology as anatomy writ large. The underlying idea of his paper is to plead for a longer, broader, deeper course in anatomy. The tendinous heart-strings of every anatomist will vibrate in sympathy, producing a symphony of musical murmurs. Perchance in some of us one of the factors will be the moderator band of the ruminant which has left its normal place near the apex of the human heart to cross near the middle of the right ventricle. The expert auscultator can recognize this cord. It is good for his patient that he should know from anatomy that such a band may be present, and that its sound is no sign of even functional disturbance. The ophthalmologist is none the worse that embryology teaches him the whereabouts of the hyaloid artery which may persist throughout life. Anomalies, therefore, as well as slighter variations, are of practical importance. The surgeon needs to know of the fibrous or muscular band which may cross the axillary artery, that the brachial artery may divide high up the arm (very rarely in the lower third), and that the diverging artery, be it radial or ulnar, almost always runs superficially. A third trochanter, which seems much larger than it is when felt through the soft parts, must not be mistaken for an exostosis, nor a deltoid tubercle of the clavicle for an old fracture. We must not forget that anyone of us may at any time meet with a very rare anomaly. I myself within a few months have seen a case of complete absence of one kidney, the other being of about the usual size and in its proper place.

But it is not necessary to turn to anomalies to support the need of a deeper knowledge of anatomy for the practitioner. The statics and mechanics of the skeleton, the action of muscles are becoming daily more important to the orthopædic surgeon and to the neurologist. The anatomy of childhood is still almost in its infancy. Though not quite helpless, it has not yet made its way into text books, but hides itself bashfully in scattered papers and monographs. A more thorough knowledge would be of great value to the practitioner in children's diseases. How interesting and how practical, in view of infant feeding, is the story of the rate of growth of the stomach in the first months of life, and how few know it !

My views of the esteem in which anatomy is held are far less pessimistic than Dr. Allen's. It is but too true that we have

many in high places, absolutely ignorant of anatomy themselves, who look on its progress with a jealous aversion. But, they are mostly passing off the stage, and they belong to a school of thought that is doomed. On the other hand, I look with confidence to the rising lights. I see in the better class of our young practitioners a great respect for anatomy. They have a clearer vision of its sphere. One of the most gratifying incidents in my professional life is the constantly increasing number of those who come to me for information on anatomical problems or for the means of solving them.

Surely after what I have said I shall not be suspected of indifference to the cause if I do not quite agree with Dr. Allen as to the remedy. He would have students thoroughly instructed in the highest anatomy before graduation. I reply that there is no time. As a practitioner myself of twenty-five years standing I am appalled at the amount of knowledge of all kinds which is now necessary for the simplest practice of the profession by anyone who would not fall behind his colleagues. I heartily agree with Huxley's saying that whoever adds one tittle that is unnecessary to medical education is guilty of a very grave offense. I would leave the matter to the good judgment and tact of the professor of anatomy. While his teaching should be eminently practical in the ordinary sense of the word, I would have him incidentally point out the explanations of structure from comparative anatomy and embryology, and still more insist on the application of morphology to disease. But I would have these things pointed out rather than pursued. I would have him show the possibilities of anatomy which, unfortunately, are impossibilities in the regular course. Thus he will enlarge the student's horizon. It is not necessary to have followed a certain line of research to know that it gives promise of great results. The mind of a student so trained will be in a very different state from that of his comrade who has been crammed with facts from a compendium. Advanced students and graduates are those to whom the highest anatomy will be the most profitable, and the more so that they can see for themselves its value, which the beginner must take upon trust.

The discussion was continued by Dr. Frank Baker, Washington, D. C., in the following paper:

Dr. Baker said: The paper of Doctor Allen brings forcibly before us subjects that are burning questions with many anatomists of the present day. The study of the human organism, of its structure, its functions, its diseases, of the effects that various

agents have upon it, therapeutically and otherwise, must necessarily be a study of life and its manifestations; it is a *biological* science, must be limited and conditioned as other biological sciences are, and have the same general laws of development and correlation. To recognize the necessity of a study of morphology as a preliminary to a proper study of disease is to insist upon this important fact.

Strictly speaking it is impossible to study the phenomena of disease properly without giving due regard to the laws of morphology. Pathology is but exaggerated physiology, pathological processes depend upon abnormal structure as physiological processes do upon that which is normal.

The great impulse given to the study of anatomy by Vesalius and his followers in the sixteenth century has not yet exhausted itself. That great reformer, with his fiery zeal and ambition, revolutionized medical teaching, insisting repeatedly and always upon the practical aspects of the science. He imagined the body as a piece of mechanism which must be taken apart to be understood. Every muscle must be dissected and its mechanics discussed, every nerve known, every vessel displayed and named. The anatomist became famous in proportion as he was a good dissector, as he had succeeded in unwrapping the structures from their envelopes of connective tissue. It became desirable to have certain fixed elements in the science. Hence there arose a disposition to regard the human body as a completed structure of a definite character, to make descriptions of it that could be easily put in a book so that students could learn them. The countless variations of all kinds that occur in every body were put aside as unworthy of discussion or as annoying abnormalities. The amount of detail involved in a description of the body became enormous, especially as it was not lightened by any attempt to ascertain the laws which produced it. Such was the Vesalian anatomy which has prevailed up to the present time and which has performed great services for mankind.

Its error consists in considering the body as an essentially fixed organism subject mainly to mechanical laws. From this view arises the notion that anatomy is a limited science; that we are rapidly approaching its bounds, and that soon there will be nothing more to investigate. Even a cursory examination of the history of the science shows how baseless is such an assumption. Vesalius knew the anatomy of the heart as well or better than Harvey; he even performed vivisections. Yet with all his wonderful power of vision and zeal for his work he did not discover the circulation of the blood. Gall knew the gross anatomy of

the brain, but was unable to properly interpret it, considering the great white bundles of the corona radiata as the essential "organs" of mind, and quite overlooking the importance of the cortical gray. Schwann discovered that the human body was composed of cells, but he believed that they were generated *de novo* in the liquids of the organism. Gerlach discovered, as he thought, in the spinal cord and brain an intricate network of nerve fibrils that he believed to be the *sensorium commune* where all impulses from without were gathered and sorted, and from which they were reflected upon the motor nerves. This has quite recently been shown to be totally erroneous. Not a day passes but some new discovery or some important generalization is made in anatomy. The books on the nervous system written even five years ago are now to a considerable extent obsolete, so great are the advances of our knowledge within quite recent times.

There has in fact never been a time when it was possible to fix any limit to the field. Whenever investigators imagine themselves at the end, a new series of developments appears showing intricacies beyond intricacies yet unfathomed. Vesalius may have supposed the task was ended when every part had been carefully and skillfully dissected and described. Yet Eustachius at the very same time was demonstrating that by macerating organs they could be resolved into a series of separate tissues. Bichat may have supposed that a complete analysis and classification of these tissues would give the final touch to our knowledge, but only a short time after his untimely death they were resolved into their component elements and the theory of the cell was evolved. Schwann may have thought that he had arrived at the final unit when he reduced all living organisms to cells, which he supposed to be simple vesicles containing fluid and a kernel or nucleus, but the more we have studied the cell the more convinced we have become that we are only at the threshold of our knowledge concerning it. Instead of the simple body conceived by Schwann we find it to be a highly complex structure containing organs and apparatuses of its own which are very far from being fully examined or understood. Instead of a uniformity it seems that we have a considerable diversity, and it is even probable that we shall have to abandon the theory that the cell is the final unit. The cell theory of to-day is very different from that of Schwann and of Virchow's Cellular Pathology. There are conflicting theories by the score, and we hear of micellæ and biophors, ids and pangenes as the ultimate elements, beyond our present powers of vision to make out, but

manifesting themselves by various phenomena that are as yet by no means fully elucidated. In fact, as the ultimate phenomena of structure are, and probably ever must be, beyond any means of demonstration by vision, it is plain that there can be no limits assigned to the investigations of anatomy.

To the modern biologist the human body is by no means fixed and invariable. The product of forces that with all our efforts we but imperfectly understand, it is incessantly changing and varying as those forces change and vary. Even within the limits of health it is highly improbable that the cells of the body remain the same for any appreciable length of time. If our inspection were sufficiently minute their structure would be seen to be as unstable as the drops of the ocean, swept to and fro by the great tides of life. Every movement of the body, every pulsation of the heart, every thought of the brain brings about some slight change, often imperceptible, it is true, but by cumulative effect becoming notable and important. In disease, when the action of those forces is greatly accelerated, retarded or otherwise modified, corresponding increments of morphological change ensue.

The human body has been studied far more than any other organic form, perhaps quite as much as all others put together. There is no lack of knowledge of facts, but for the ordinary student the details are not classified and arranged as the results and sequences of morphological laws. Our arrangement is as yet empirical, and we are laboring under the same difficulty that botanists formerly were, inasmuch as we are piling up details upon details without really understanding what they mean or seeking to discover the laws which correlate and control them. The muscular system is described very much the same as Vesalius and Albinus described it, the origins, insertions, shapes and relations of muscles being given without any attempt to analyze the laws that govern their formation, attachment, growth and transference, or the causes of the distribution of the muscular masses. Again, the trunks and branches of the arterial system are studied without considering for a moment the rationale of their development, their origin from a network of amœboid connective tissue cells, and their growth from the periphery toward the center of the body. Yet these facts of morphology are important. The moment we conceive the vascular system as an arrangement of connective tissue structures, a thousand facts with regard to the distribution of vessels and the vascular supply of organs become clear. We see why vessels seek the connective tissue septa, why they penetrate organs between their

lobes, why they are subject to certain anomalies of arrangement and distribution, why they are reformed in wounds out of the connective tissue of the surrounding regions.

We may even say that inflammation itself, that process so intimately connected with the phenomena of disease, cannot be properly understood without a knowledge of the morphological character of the tissues involved. It seems clear that the main factors in this process are the cells that constitute the vessel walls. Since these are derived from the original wandering cells of the mesenchyme of the embryo flattened out and arranged to form tubular structures, it is not strange that they should revert to their primitive character when subjected to special stimuli. The different phenomena of inflammation appear to be due to such a reversion. The cells of the vessel walls resume to some extent their independent activities, expanding, contracting, so as to permit extravasation of the vascular contents, and finally proliferating, producing other cells that form the looped vessels of granulation tissue and the dense fibrous masses that finally fill in the gaps and make the scars. Morphologically speaking, the whole is merely a phase of cell-life in the connective or mesenchymal tissue. I by no means assume that we as yet fully understand this. The life processes of any cell of the body are too complicated for us to analyze. We do not know why some stimuli set certain cells in action while others affect a different set. But it certainly makes it much clearer to know that we have before us a series of processes similar to those which occur regularly in the growth of the embryo. That in many cases microbes or microbic products are a factor in the production of inflammation only adds to the force of the argument. The rapidly growing science of bacteriology is really only a branch of morphology. Microbes are but isolated cells having the same intimate structure, subject to the same laws of growth, reproduction and life as the cells of the body. Indeed it is only by studying the activities of such independent units that an adequate idea can be obtained of the life phenomena of the cells of the organism. From recent investigations it would appear that we have been classing together as white blood corpuscles a number of forms that are quite different in their structure and in their behavior toward staining fluids. The relation of all of these to the phenomena of inflammation has yet to be investigated. It can hardly be doubted that important results will ensue.

The whole subject of tumors has, since the celebrated investigations of Virchow, been studied from a morphological stand-

point, and it has become evident that in order to understand their causes and their history we must know more about the laws that control cell formation and the growth of tissues. The very fact that the cells of a sarcoma have no analogy with any adult tissue, but represent a primitive, embryonic form not normally present in the matured body, is of the deepest interest to the morphologist.

As the coral reef is built up by the combined efforts of myriads of zoöphytes, so is the human body built up by its cells. The gross variations in form must depend finally upon these minute cell activities. These variations may be of all grades, from the slight and insignificant changes in texture that we recognize as individual peculiarities, up to the striking deformities treated under the head of teratology. A proper consideration of these is of as much importance to pathology as to normal anatomy. Any of them may be the initial or secondary cause of some diseased action.

The morphologist studies these variations as indicating slow modifications of the form of the human body. For it is well known that like all other living things the body of man is slowly changing, that adaptations are always going on within it slowly fitting it more and more to its environment. Organs disused for a long period of time atrophy and are replaced by adaptations better suited to sustain the activities of the moment. Thus there are constantly left behind a considerable number of structures that have ceased to be of any considerable value, organs that are properly termed *vestigial*; and as they no longer represent a proper adaptation to the environment they are fruitful causes of disease.

Among such may be noted the vermiform appendix of the cæcum, the rarely seen Meckel's diverticulum of the intestine, the thyroglossal duct (by which the thyroid gland formerly discharged a secretion at the base of the tongue), the persistence of the primitive neutral form of the genital eminence producing hypospadias, the persistence of the choroidal fissure of the eye, producing coloboma.

A large mass of anatomical evidence shows that the erect position which man alone of all vertebrates possesses, was gradually acquired. I have reviewed this evidence elsewhere and will now merely mention that it is of great force in its cumulative weight. What especially concerns the present discussion is that in many respects the body has not yet become perfectly adapted to the erect posture and that many causes of disease may be traced to this maladaptation. The shape of the

pelvis has necessarily become modified in order that it may support the weight of the viscera, yet with all this that weight is often the cause of hernia, and besides, the contraction of the pelvis necessary for support prevents the expansion necessary for the passage of the child's head in parturition. Consequently the pelvis of the civilized woman of to-day is less adapted for easy parturition than is that of her savage sister of the Australian bush, or her savage grandmother of the stone age. It is true that by the thickening of the fascia of the lower abdominal wall some attempt is made to remedy these defects, but the passage of the spermatic cord and the round ligament greatly weakens that support. The frequency of uterine displacements and the tendency of concretions to gather at the most inert portion of the bladder are both consequences of the erect position. Many of the abdominal viscera show signs of maladaptation. The cæcum and the ascending colon are not favorably situated for carrying off masses of fecal matter; the pouches and folds of the peritoneum are not arranged so as to best avoid the entangling of the intestines; the heavy liver, instead of being suspended from the spine, has become slung from the diaphragm, which must therefore, to support the weight, acquire strong connections with the pericardium and the fascia that supports the heart, thus producing below and on either side of each lung strong unyielding walls of fascia that restrict its growth and expansion far more than it is restricted in quadrupeds. The heart itself works to much greater mechanical disadvantage, having to pump the blood to a much higher level and against far greater hydrostatic pressure. From this it can hardly be doubted comes something of the greater tendency of man to affections of this organ, and especially to some of the special consequences of these affections, such as ascites, anasarca, venous congestion, etc. It has been clearly pointed out that the valves in the veins are not adapted for the erect position, and that varicose veins are in general due to this cause. It will be seen, therefore, that the study of morphology has in this case indicated the cause of a number of widely different disorders.

No doubt as the science progresses and we become accustomed to consider the phenomena of disease more and more from the biological standpoint, many important generalizations will be made. Some already seem to be almost ready for statement. Among them I will mention what may be called the law of stability. It is this: that the stability of a structure varies directly according to the time it has been functionally active in the ascending series of animal life. The structures most readily at-

tacked by disease are those at either end of the scale of activity, that have wholly or partially gone out of use (regressive structures) or have recently been added to the animal economy (progressive structures). The original elementary tissues, epithelium and connective tissue, are the most stable; their derivatives, nerve tissue, muscle tissue, glandular tissue, are the least stable. We may even adduce certain details. In the nervous system it is well known that disordered function first appears in the higher or more recently established portions. Loss of memory is doubtless nothing more than the loss of function of associative fibers. In old age there is a gradual and progressive extinction of the higher faculties until at last, unless some accidental disturbance supervene, the nervous activities are reduced merely to those necessary for nutrition, and man has become an oyster. In lead paralysis, pen paralysis, the sudden weakness of the knees in fainting, etc., etc., we see groups of organs that have been but lately added, comparatively speaking, first giving way under strain. In certain other cases there is weakness derived from the progressive atrophy of disused organs. Wiedersheim has pointed out that tabetic affections of the spinal cord are especially likely to affect the lumbar enlargement next to the filum terminale, being apparently an upward extension of the atrophy that has been affecting that structure which is, as is well known, the remains of a former extension of the cord. The apex of the lung is another structure very prone to disorders and in like manner represents a reduced portion of the organ which primitively extended farther toward the head.

It has been possible for me to give only a hurried sketch of a few salient points of this great topic. Morphology is throwing light upon a vast number of subjects connected with the domain of medicine, not only upon the causes of diseases, but upon the action of cells, the problems of therapeutics, the very springs of life and the laws that underlie heredity, development, training and education. It is a growing science, one that is destined to a great future, promising much for the elucidation of the highest problems of medicine.

DISCUSSION BY DR. BURT G. WILDER, OF ITHACA, N. Y.

Dr. Wilder said: I regret that I have been unable to prepare a formal paper for the discussion of this subject, but during the past month every moment of available time has been spent in the study of a specimen of great interest. This specimen, however, is directly in line with the problem which Dr. Allen has offered. If I understand his thesis, it is that *structure is a*

record of function, and that diseased structure is a record of disordered function ; more specifically, there is no psychosis without a neurosis of some kind, and the tendency among psychiatrists of the present day, if they can not find in the brain something which accounts for the mental conditions which were observed during life, is at least to assume that it was there. Now, as a biologist primarily, and a neurologist secondarily, and a psychiatrist not at all, I suggest respectfully that that is not a sound method ; it is begging the question. This is precisely what we want to know, whether the brain which we study from a person who was abnormal morally, or intellectually, or with respect to capacity, does embody in its gross structure or in its microscopical constitution, peculiarities which are departures from the standard.

The specimen to which I have referred, and which I shall show to the Neurological Association, is the brain of an educated man, a dentist in the prime of life. I had observed no evidence of insanity unless we interpret as such the fact that he had executed a document dedicating his brain to me according to a plan which I have put in operation at Cornell University. Since however, I have the promise of the brains of several professors, students and others, I cannot admit that this promise should be regarded as *prima facie* evidence of aberration. Nevertheless, within four months after the promise was made, this gentleman not only committed suicide, but in one sense committed it twice. He wrote a letter declaring that he was going to kill himself. He was found lying dead with a pistol grasped in his right hand and two bullet holes in his head not on opposite sides. One was in the middle of the forehead and the other in the right temple. In making the first wound he apparently endeavored to injure the brain as little as possible. This ball was deflected by the skull, abraded the cortex, and lodged near the precommissure. The second ball traversed the right subfrontal gyre, the callosum and the left central region.

Now this gentleman had informed me that he had a great source of sorrow ; he had lost the lady whom he intended to marry within a short time of the date fixed for the wedding ; he also had some money difficulties. He was a skillful dentist, and an assiduous student. But after his death, I heard that he had several peculiarities, and that some even considered that his mind was disordered.* It might well be supposed that some-

* He had three brothers and two sisters, all living. One of the brothers writes me : " There has never been a suicide or any insanity in our family, nor, so far as I can learn, in the families of either of our parents for two generations back " This in contravention of a report, apparently authenticated, at first too hastily credited by me.

thing unusual would be found in the brain of a person, who after putting one pistol ball in his brain had the persistence and self-control to put a second ball therein. And indeed it does present a most unusual condition of the fissures. During the past month I have done little more than pore over this brain and the photographs which have been taken of it. This is the reason that I have been unable to prepare a discussion of the paper read this afternoon.*

I should like to add a few words in direct corroboration of Dr. Baker's declaration that the human body is not to be regarded as a completed structure. It is far from being complete in several particulars, and I think physicians should consider very seriously whether it is not their duty to hasten its improvement in one of these, namely, by the elimination of that worthless and dangerous heirloom, the appendix of the intestine. This matter has come home to me very closely. In the last two years there have been removed in my neighborhood thirty appendices by one surgeon. One of these belonged to the daughter of a colleague; another belonged to a professor himself—not even the elect are exempt. This gentleman declares himself in better health than for several years before, and commiserates his appendiciferous associates. From recent surgical literature, it appears that the operation for the removal of the appendix, supposing it not to be in a gangrenous condition, presents no great likelihood of mortality—that with present precautions it is a comparatively safe operation. It is now four years since I proposed we should not only vaccinate but also de-appendicise; that the child, at a period of life when time is not valuable, and when it might have the best possible chance for survival, should, with proper precautions and with the consent of its parents, be relieved of this organ which later might occasion great loss of time, suffering and perhaps death.

There is a corollary to this. The only mammals besides ourselves which are cursed with the appendix are the four anthropoid, tailless apes, the gorilla, chimpanzee, orang and gibbon, passing over some possible exceptions among the lemurs and marsupials. Should there ever be in this city, or elsewhere, a collection of these very interesting animals, they should have the benefit of the experience through which the human race has passed. In disorders of the abdomen not otherwise accounted for, the appendix should be inspected. In these apes also the

* By a vote of the Congress Dr. Wilder was requested to furnish a report of the above case for publication in the Transactions. (See Appendix, Transactions of the Congress.)

appendix is usually longer and more contorted than in man. The fact that the appendix of man is smaller, simpler and hence less dangerous than that of the ape, may have been one element in his success in the struggle for existence, and in gaining superiority over these, our poor relations.

One more point. Dr. Dwight has alluded to the difficulty of including more branches in the curriculum of our medical schools, and to that I say Amen and Amen. As I declared in 1877,* the curriculum is already crowded almost beyond endurance. What we want is to make morphology a subject of common school education, and I predict, on the basis of twenty-six years experience as a teacher, that it will not be long before all college educated persons will know fully as much anatomy, physiology and morphology in the broad sense as is now obtained by the average physician. By this we shall gain two things: for the medical student, a sound basis for the strictly professional branches; for the profession, the intelligent and sympathetic support of a community well informed as to the facts and principles involved in the elucidation of hygienic and biologic problems.

Dr. Allen closed the discussion, saying: I have little to add in conclusion except to express my gratification and my thanks to the gentlemen who have so fully discussed my paper and entered into sympathy with it.

Dr. Dwight used the term "pessimistic." I should be sorry to be considered pessimistic. I have no ground for being pessimistic. I believe that in the University with which I am connected, students will have the opportunities which I have mentioned. In most institutions I regret to say the standard of anatomical teaching is practical in character and not the one which is most useful as a discipline of the mind.

How are we to obtain the best results in teaching morphology? I agree with what has been said as regards the crowded condition of the curriculum, and I would not add anything to it. I heartily approve of what Professor Wilder has said; we should push instruction in anatomy and chemistry back to the earlier years in general education. The student is receiving instruction now that he should get in the college course. All that he now secures is rudimental. The professor of anatomy should deal more with such problems as I have referred to, and the student must be prepared to understand them. The chemical instruction

* Should Comparative Anatomy be included in a medical course? Introductory Lecture at the Medical School of Maine.—*N. Y. Med. Journal*, xxvi, 337-379.

which he now receives at the medical college should be available at a much earlier period. In my judgment valuable time is lost to the medical student in his studies in rudimentary chemistry and physics. These matters should not go into the medical course at all. If the student were properly qualified, that time would be saved. The time thus gained would be given to anatomy. After all, these are matters of detail, and could be easily managed if faculties were in sympathy with the ideas I have endeavored to promulgate. Unfortunately they are not. Dr. Baker dwelt upon histology. I did not go into that subject; yet as I understand it, my position is strengthened by the one he takes. The mechanical disadvantages of the upright position explain conditions that the surgeon is constantly studying. The etiology of many lesions depends upon this general theorem, and the study should be part of every anatomical course, no matter how urgent become the appeals to the attention of the student in directions other than those that are strictly morphological.

But we must not forget that, even if the method of teaching in the class room or lecture hall remains unchanged, much can be done by giving advanced students opportunities of inspecting specimens appropriately arranged in museums, or, what is better, investigating the structure—under varying phases of nutrition—of *living animals*.

The following are the *abstracts* of the papers read and discussed in the sessions of the Association :

"IDENTITY OF STRUCTURE OF PROTOPLASM WITH THAT OF
STRIPED MUSCLE," BY DR. CARL HEITZMANN,
OF NEW YORK CITY.

Since Stricker, of Vienna, published, in 1890, a photomicrograph of a living colorless blood corpuscle of a newt, plainly exhibiting the reticular structure, all doubts about the existence of such a reticulum must have vanished. When, in 1873, I discovered this structure, my nomenclature was extremely simple. I termed the reticulum, *i. e.*, the granules at the points of intersection, the connecting threads, the central nucleus and the covering layer of the protoplasmic lump, the "living or contractile matter," whereas I considered the meshes of the reticulum as being filled with a nitrogenous, though lifeless, fluid. Even to-day I would object to complicated names (*hyalo-plasma*, *paraplasma*, *chromatin*, *achromatin*, etc.), used by German and French observers. I saw in the *amœba*, at one point of its body, an increase of the size of the granules on approach to one another, and a shortening of the interconnecting threads, which condition I termed "CONTRACTION" of the living matter; the fluid held in the meshes of the reticulum of the contracted portion I thought was driven to an opposite point of the *amœba*, where the reticulum became stretched, the granules decreased in size, the threads elongated, and the meshes became enlarged. This condition I termed "EXPANSION" of the living matter. In the highest degree of expansion, when a hyaline flap is protruding, the reticulum is stretched to the utmost, being even lost to sight. An *amœba* can change its shape, but not its place, as long as it is suspended in the infusion-liquid. Migration begins only after the protruded flap found a point of fixation on the slide or the cover-glass. The body of the *amœba* is dragged toward the point of fixation when rest is re-established. Upon the principle of "contraction" and "expansion" of the reticulum of living matter, the locomotion could easily be explained.

The structure of striped muscle-fibers is identical with that of protoplasm in general. The only difference is, that in the latter the reticulum of the living or contractile matter is arranged

without regularity, whereas in striped muscle, the prisms, being identical with the "granules" of the protoplasm, termed "*sarcous elements*," are arranged in rows and discs with great regularity. The large prismatic pieces producing the broad rows often alternate with rows of granules in varying numbers, but whatever be the shape and size of the formations of the living or contractile matter in the striped muscle, they invariably are interconnected by means of delicate conical threads both lengthwise and in a transverse direction. These threads of contractile matter always run from one sarcous element to another, never *between* the sarcous elements; the threads may inosculate with the bases of the sarcous elements, or they may by fusion produce a hollow chamber, attached to the periphery of the sarcous elements. The light lines between the rows of the prismatic pieces of the contractile matter correspond to interstices filled with a nitrogenous fluid, which fluid is present also in the compartments produced by hollow cylinders alternating with the solid ones.

The phenomena of contraction are identical both in the protoplasmic lump and the striped muscle fiber. In the latter the rows of sarcous elements broaden, which means an increase in the bulk of each single sarcous element; the connecting threads shorten; the liquid held in the interstices between the discs of sarcous elements is pressed into the lymphatics, for the benefit of the antagonist, in which the contractile matter is stretched, owing to a surplus of interstitial liquid.

The condition of rest is established in the equilibrium of two sets of muscles, antagonistic in their action. The condition of rest is shown under the microscope at the moment of death of the muscle-fiber, as E. Bruecke has demonstrated, in nine different relative positions of the sarcous elements and the granules, all being living or contractile matter.

To queries by Professor Wilder, Dr. Heitzmann replied:

The structure of the gray nerve substance and the ganglionic corpuscles imbedded therein is identical with that of protoplasm in general, *i. e.*, reticular.

The nerve action I base altogether upon the contraction of the living matter; the differences in the structure of the ganglionic bodies, while at rest and after irritation, have been demonstrated by Professor Hodge; they are much the same as in the epithelia at rest and after irritation.

The anatomist is satisfied with what he can demonstrate, and will be loth to admit mere functional powers, independent of

the body, especially of the nerve organs. The name of an "agnost," as established by Huxley, fully expresses our creed; we know what we can prove by our senses, and we frankly admit not to know what we are unable to demonstrate.

"PROBLEMS CONNECTED WITH THE CEREBRAL FISSURES,"
BY DR. WILDER.

[To be published in the *Journal of Comparative Neurology*, 1894-'95, and in Lectures before the Marine Biological Laboratory at Wood's Hole for 1894.]

With consent of the Association, this paper (originally one of two prepared for the Neurological Association), was substituted for the two announced on the program, viz: "The Relation of the Olfactory to the Cerebral Portion of the Brain," and "Notes on the Anatomy of the Orang." The dissection of the Orang (a large female, thoroughly preserved by arterial alinjection,) is not yet completed. The laryngeal sack is very extensive, communicates only with the left side of the larynx, and is undoubtedly lined throughout by mucosa. The brain is in perfect condition, and presents a metapore (foramen of Magendie) as already stated in the *Philadelphia Medical News*, Oct. 14, 1893. and the "Reference Handbook of the Medical Sciences," IX, 616, 1893. The subfrontal gyres, (Broca's convolutions) are very well developed. Dr. Wilder regretted particularly that it had been impossible for him to prepare a full statement of his views as to the relation between the olfactory region and the brain and the pallium or mantle or cerebrai portion proper. Not only do his recent observations and reflections tend to confirm the view independently expressed by Spitzka and himself many years ago, as to the primary and morphological importance of the sense of smell and its organ, but he is now prepared to affirm the view which was tentatively stated in 1889 ("Reference Handbook of the Medical Sciences," VIII, 114, note), as to the segmental value of the rhinencephal, comprising "the olfactory bulbs, their crura, part of the precommissure and a corresponding portion of the aula;" on this point see also Mrs. S. P. Gage's remarks in "The Brain of *Dermogyrus*," etc., the "Wilder After-Century Book," p. 207, 1893.

As to the Cerebral Fissures, Prof. Wilder called attention to a fact that about fifty such wrinkles on the organ of thought have been named and more or less fully described and figured. Each of these requires monographic treatment under about fifty distinct topics, and the order of treatment should be uniform so far as possible. But in addition to the specific questions to be

answered for individual fissures, there are about one hundred problems of a more or less general nature, applying to several or all of the fissures. A few examples only were stated :

1. Are any of the transitory or temporary fissures constant in location or direction ?
2. Are any of them merely artifacts ?
3. Are any of them due to other causes than the mechanical one commonly assigned, the increase of the cerebral sacks at a rate greater than that of the cranium ?
4. Is their disappearance due to an unfolding only, or is there an absorption of substance or fusion of opposed walls ?
5. What is the occasion of such marked asymmetry in the formation or disappearance of the transitory fissures as is exhibited by the embryo figured in the "Reference Hand-book of the Medical Sciences," VIII, pp. 114 and 148 ?
6. Are transitory fissures formed in any animals ? So far they have been observed only in man ; but, before concluding that here is one of the small number of absolute human peculiarities, embryo apes should be examined.
7. What are the immediate causes of the formation of the permanent fissures ?
8. Are any caused by the resistance of vessels ?
9. Do vessels simply take advantage of certain fissures ?
10. What fissures change location relatively to the sutures ? In this connection reference was made to the fissure called by Dr. Wilder, *lambdoidal*, from its constant collocation in mid-term fetuses with the suture of that name ; yet its later history is unknown.
11. At what period, before or after birth, do new fissures cease to appear ?
12. What fissures are peculiar to man ?
13. What fissural connections or disconnections are peculiar to man ?
14. To what extent may the elucidation of human fissural problems be aided by the conditions in apes, monkeys or lemurs ?
15. What is the significance of the fact that continuity of two fissures (or elements of one fissure) is more common on one than on the other side ? For example, the paroccipital and parietal, as observed by Ecker, Cunningham and the speaker, " Jour. of Nerv. and Mental Disease," XIII, 464, 1886.
16. May the term *fissural integer* be clearly defined at present ?
17. How far may fissures be homologized throughout the mammalia ?
18. Are there two or more criminal or insane types of fissures ?

19. Is there a carnivoral type?

20. What is the fissural pattern of the normal human being?

Prof. Wilder urged the supreme importance and difficulty of the problem last stated, and the desirability of aiding its solution by the preservation and extended study and comparison of the brains of many moral and intelligent persons. A collection of such had been begun at Cornell University, and a considerable number of members or friends of the institution had signed copies of the blank form here appended.

"FORM OF BEQUEST OF BRAIN.—I, _____, now of _____, student of Cornell University from _____ 18—, to _____ 18—, and graduated in 18—, recognizing the need of studying the brains of educated persons rather than those of the ignorant, criminal or insane, in order to determine their weight, form and fissural pattern, the correlations with bodily and mental powers of various kinds and degrees, and the influences of sex, age and inheritance, hereby declare my wish that, at my death, my brain should be intrusted to the Cornell Brain Association (when that is organized) or (pending its organization) to the Curator of the collection of human brains in the museum of Cornell University, for scientific uses, and for preservation, as a whole or in part as may be thought best. It is my hope that my family and friends may not oppose the fulfilment of this my earnest wish.

Signature, _____.

Date, _____.

Witness, _____.

"*Note*.—Copies of provisional diagrams of the fissures will be mailed upon application to the undersigned. For a brief statement of reasons for the study of the brains of educated persons, see "Buck's Reference Handbook of the Medical Sciences" (Wm. Wood & Co., New York), VIII, 163, and IX, 110.

"BURT G. WILDER, M. D., Professor of Physiology,
"Vertebrate Zoology, and Neurology, Cornell University, Ithaca, N. Y."

Dr. Heitzmann discussed Dr. Wilder's paper; he said:

The essayist made the remark that in comparison with the brain of lower animals the human brain is a complicated, almost incomprehensible organ. It is plain that lower animals need centers—olfactory, optic, etc.—for no other purpose but that of catching food, whereas in man, the lobes, mainly the frontal ones, are the seat of so-called "intelligence," which involves, aside from the capacity of reasoning, that of speculation, and of conceit. This feature is especially well pronounced in the brain of the philosopher in contradistinction to that of the Swedish carpenter. So long as we know so little about the human brain, the attempts at a new nomenclature are not quite justifiable.

“A PLEA FOR A METHODICALLY-WRITTEN TEXT BOOK ON
ANATOMY,” BY DR. EDMOND SOUCHON, UNIVERSITY
OF LOUISIANA.

[To be published.]

It is the belief of the writer that students of anatomy would better learn and remember the innumerable and more or less complicated facts of this branch of science if they had at their disposal a text-book, written with constant uniformity and rigorous method.

The guide or course followed in describing the organs should be inexorably systematic, and always the same for each and every one of the organs, and apply as well to the largest organs as to the smallest, even to a cell.

I have elaborated such a guide, and I here present it for consideration to the members of the association. Of course, the guide or course describing an organ should be followed more or less closely according to the importance of the organ or of the facts connected with it. If some facts connected with one particular part of an organ are of no importance, they should be skipped, and stress should be laid upon those facts only which present a practical bearing or a scientific interest.

It would be essential to follow the guide systematically, as one fact is so intimately connected with the following, that the place where to say it cannot very well be altered without disturbing the harmony of the whole. There is a place for everything, and everything should be in its place. We should say at the beginning what belongs there, and not say it in the middle of the description; again, we must say in the middle of it what belongs there, and not say it at the end.

The same course is applicable to bones, ligaments, vessels and nerves, although it may seem odd at first since it is quite a departure from the old plan. It would be a waste of time before such an audience to give any example by actually describing a muscle or nerve after this plan.

All the above points and details are summarized in the following table:

GUIDE TO DESCRIBE AN ORGAN.

1. *Definition*.—Synonymy; Etymology; History.
2. *Division of a complicated organ into separate portions and description of each portion as separate organs.*
3. *Number*.—Single or double; Supernumerary organs; Absence of the organ.

4. *Dimensions*.—1. Relative size, or size compared to other organs or to familiar objects. 2. Absolute size: Diameter, transverse, vertical, antero-posterior; Caliber.

5. *Situation*.—1. General situation or region it occupies. 2. Relative situation, as compared with the surrounding organs.

6. *Direction*.—1. Compared with axis of body. 2. Compared with its own axis.

7. *Means of Fixity*.—Adhesions; Ligaments; Vascular connections; Supported by other organs.

8. *Mobility*.—Of the whole organ; Of a part of it; Intrinsic mobility; Extrinsic mobility, or communicated by other organs; Extent of mobility; Exceptional mobility.

9. *Shape*.—Compared to a geometrical figure; Compared to the shape of a familiarly known object.

10. *Surfaces*.—Synonymy. Direction: forwards or backwards; Above or below; Intermediate direction. Shape: Plane, concave or convex; Vertical or transverse direction. Peculiarities: Projections—folds; processes, ridges or crests; tubercles; protuberances. Depressions—orifices (size, shape, boundaries, structure, contents); Blind foramina; Grooves and canals (depth, extent, contents, vessels, or nerves or organs). (When enumerating peculiarities, begin on the median line, and then on the sides; proceed from before backwards, or from within outwards, or from above downwards.) Relations—With skin (*i. e.*, to what part of the surface it corresponds), or with bones, joints; Muscles; Viscera; Vessels and nerves.

11. *Borders*.—Synonymy. Dimensions. Direction: 1. Relative direction—vertical, horizontal, oblique, forwards, or backwards, or above or below, or inwards or outwards. 2. Absolute direction—straight, sinuous, concave, convex. Shape—Blunt or sharp, or beveled at the expense of one surface or the other. Peculiarities—as for surfaces. Relations—as for surfaces. All thick borders ought to be subdivided into two edges or lips, and an interstice. Give, for each, peculiarities, insertions and relations.

12. *Angles or Extremities*.—Same as borders. Base and Apex—same also.

13. *Structure*.—Color, Consistency—Density; Friability; Elasticity. Contractility. Envelopes or Coats—Thickness; Resistance; Elasticity. External Surface—Relations; Adhesions. Internal Surface—Relations; Adhesions; Processes from internal surface; Reflections into the interior of the organ. Stroma—If delicate or apparent; Is composed of connective tissue, or elastic, smooth, muscular fibres. Proper or Characteristic

Elements—Cells; Tubes; Fibers; Prisms. Capillary Arteries; Veins; Lymphatics; Nerves. Excretory Duct of Glands (as a separate organ). Lining Membrane of a Hollow Organ; Thickness; Consistency; Elasticity; Adhesive Surface (degree of adhesion). Free surface—Color; Peculiarities; Epithelium; Glands.

14. *Chemical Composition*.—Organic, Inorganic elements.

15. *Development of the Ages*.

16. *Peculiarities or Varieties, or Anomalies due to Sex, Habits, Trades, Constitution, Individualities, Nationalities, Races*.

Drs. D. K. Shute and Wm. P. Carr, of Columbian University, Washington; Dr. T. N. Gill, of Washington, and Dr. Baker, discussed the paper. No abstracts of their remarks have been received.

In discussing Dr. Souchon's paper, Dr. Dwight agreed that a methodical system of discussing regularly the points which are to be described, would be an advantage to both the teachers and the students. In this connection he spoke in favor of introducing topographical teaching and surface anatomy very early in the course. The bones and joints should be taught at once, and later in the course the distribution of blood-vessels and nerves at the same time.

Dr. Wilder said: I wish the paper had comprised an application of the system to some organ, especially to one of the viscera. While some system is very desirable, and it should be uniform, or nearly so, for all of a series of similar parts, *e. g.*, the muscles, nerves, *etc.*, the viscera, especially the brain, may involve considerable modification. In all cases it seems to me that a figure should occur near the beginning of the account, together with specific references to other figures in which other aspects are represented. The detailed description should be preceded by a very general statement of the location and approximate size and form of the organ. During the present term I have formulated for my class in Neurology an order to be followed in discussing a cerebral fissure, and find that there are about 70 points to be considered embraced under 15 or 16 heads. Dr. Souchon has recognized the value of an account of the development of organs for a comprehension of their adult structure; this was insisted upon by Dr. Baker in 1884 (*N. Y. Medical Record*, p. 421), and it is gratifying to note that in the new edition of "Quain," Embryology con-

stitutes the first part of Vol. 1. But it seems to me that at the beginning of the work should come only the account of the ovum and the earlier stages of the development of the body as a whole, while the mode of formation of each organ or system of organs should be presented in connection with its description, probably between the general and the detailed divisions.

Dr. Harrison Allen spoke of the plan of Otto's Anatomy. This work was unknown to the speaker in the original, but he had referred many times to the translation by South which bears the title "A Compendium of Human, Comparative and Pathological Anatomy." The criticism of almost all methods of teaching anatomy is that they are too encyclopædic. The human body is treated as though it had never been alive, and is being taken apart as a house might be dismantled and razed to the ground. If it were treated more as a machine whose fire has gone out of the furnaces, and yet is constantly suggesting the uses to which the machine had been put during life, the plan would carry more weight and interest than is now possible.

**"ON THE SHORTENING OF THE FACE-AXIS IN THE EVOLUTION OF
THE MAMMALIA," BY DR. ALLEN.**

[From the Proceedings of the Academy of Natural Sciences, Philadelphia, 1894,
p. 181.]

Dr. Harrison Allen remarked that the anatomist, while interested in establishing co-ordinates, is well aware of the difficulties which are continually encountered. Still it must be acknowledged that co-ordinations exist between the component parts of every organism, and as knowledge extends they will be gradually formulated.

The ensuing observations may be of value in denoting the kinds of changes which take place in the skull upon the shortening of the face-axis.

It has been assumed by authors that the shapes and positions of the teeth are the chief agents in modifying the shape and the size of the region of the face. In Chiroptera this is not the case. In comparing the cranium of the long-faced *Chocronycteris* and the short-faced *Ametrida*, it is remarked that not only are the face proportions contrasted, but those of the zygomatic arches are changed (namely, in being slender or absent in the one and high in the other), while the face is broad at its base and the mesopterygoid fossa widened. The greyhound and the English pug-dog exhibit similar contrasts. In these varieties, in addi-

tion, the tympanic bulla is relatively larger in the pug-dog than in the greyhound. In Proboscidea the contrast between the length of the face-axis in *Mastodon* and *Elephas* can be expressed in the development of the pneumatic spaces in the skull; not, indeed, by the inflation of the tympanic bullæ, or other parts of the base of the skull, but by the inflation of the diploic structure of the frontal and parietal bones.

In Edentata the difference between the long-faced *Tatusia*, *Myrmecophaga* and the short-faced *Megatherium*, *Bradypus* and *Choloepus*, is about what has been already noted in the foregoing examples. The zygomatic arch in the group last named, although incomplete, is high. The tympanic bulla, it is true, is inconstantly inflated, but that of the sinus in the frontal bone, compared with what is noted in the long-faced types, is like that which is seen in *Elephas* as compared with *Mastodon*.

Similar points can be established in the Quadrumana. *Macacus* can be separated from *Cynopithecus*, not only by the length of the face, but by *Macacus* having a more inflated tympanic bone. The same remark is true of *Propithecus* and *Nycticebus* as compared with *Lemur*.

The genera of Carnivora, as illustrated in *Melursus* and *Helarc-tos*, are in evidence of the same general statement.

Even in birds, as was suggested by Mr. Frederick Lucas to Dr. Allen, the difference between the owl and the pelican and stork can be denoted by the amount of diploic structure in the head, as well as by the length of the face.

In Artiodactyla the evidence is obscure. In the remarkable fossil genus *Cyclopidius*, described by Prof. Cope, all the co-ordinates appear to be well established, namely, an extremely short face-axis is accompanied with great increase of width of the zygomatic arches and large tympanic bones. But these bones are generally large in the long-faced artiodactyles. The influence of many factors of necessity must be borne in mind before all the terms of an equation can be determined.

Care must be taken not to confound an isolated inflation of the tympanic bulla with the probable co-ordination above named. In *Corynorhinus*, *Euderma* and *Dipus*, as in some species of *Vulpes*, the inflation is correlative with the size of the auricle, at least is independent of the problem of face-shortening.

Many suggestive features present themselves in the skull of man. The inflations here, while basic, are not seen in the tympanic bones, but in the tissue at the median aspect of the petrosal bones, and at the sides of the exoccipitals. Prognathic and orthognathic forms can be distinguished, as a rule, readily

by these parts of the base of the skull ; but, as in all things pertaining to the study of the human skull co-ordinations are exceptionally difficult to establish. We are here dealing not with characterizations of a generic kind, but with those which are mutatory in tribal or racial groups of sub-species, and it is not reasonable to look for features so sharply defined as are those of genera of quadrupeds.

Mr. Frederick Lucas said: That while it might be merely a coincidence, yet such short-faced birds as the Owls and Goat-suckers and Parrots were notable from the amount of diploë in their crania. In reply to a question by Dr. Allen he said, that the Gannet and Pelican were long-faced birds and remarkable for the pneumaticity of their skeletons as well as the presence of large air sacs about the breast, and yet these birds had rather thin, hard crania ; so do the Herons.

NOTE.—On examination the Gannet has some little diploë in the frontal region, above the eyes, but little in the wall of the cranium proper.

ON A NEW METHOD OF DETERMINING THE HORIZONTAL PLANE OF THE SKULL. DR. ALLEN.

Dr. Harrison Allen described a new method of determining the horizontal plane of the skull in the absence of the face. The ability of studying the brain-case on the same conditions as are presented in entire specimens of the skull is a desideratum in craniology. The plane usually accepted, and which is known as the German horizontal plane, is defined by a line drawn between two points, one of which is secured at the upper border of the external auditory meatus, and the other at the inferior border of the orbit. The plane proposed by Dr. Allen is a line drawn between a point at which the produced line of the crest of the petrous portion of the temporal bone would appear on the superficies of the skull, and a point at the pterygoid ridge. In truth, the point first named might be placed on the superficies, at the junction between the squamosal and mastoidean parts in the parieto-temporal suture. But the variations noted in the manner by which this junction is effected are of a character which make it desirable to fix the point after the manner already given. It is recommended that the following procedure be adopted: The left hand is inserted in the foramen magnum, the crest of the petrosa, is carried outward to the index finger of the right hand can now find on the point which corresponds to the position of the

tip of the left index finger,* and this will answer pretty accurately to the junction of the squamosal and mastoidean elements, as already mentioned. The second point lies at the pterygoid ridge, at the exact point at which the concave surface for the temporal muscle on the vertical limb of the great wing of the sphenoid bone ends and the horizontal or basal limb begins.

When a skull is placed in a craniophore and the two points named are brought in the same line it will be found that the difference between the plane thus defined and that of the German horizontal plane is so slight as to be practically *nil*.

The selection of the points named for a horizontal plane was made on the supposition that the level of the base of the brain affords available criteria. The squamoso-mastoidean junction on the superficies corresponds to the anterior boundary of the tentorium and thus nearly to the position of the transverse fissure, while the point at the pterygoid ridge represents the under surface of the sphenotemporal lobe.

Drs. Gill and Baker discussed the two papers, but no abstracts of their remarks have been received.

Dr. Heitzmann said: Prof. C. Langer, of Vienna, claimed that in a perfect skull the horizontal plane is easily determined by the horizontal positions of the zygomatic arch. Should this be composed of two devious portions, take the mean of the two and you obtain the horizontal plane of the skull.

Dr. Wilder said: My only experience in this subject was in determining the relative positions of the cerebrum and cerebellum in apes (*Amer. Assoc. Adv. Sci. Proc.*, 1884, p. 527). For this purpose the natural position of the head seems to be with the orbital axis horizontal, coinciding with the plane of vision in looking horizontally. But it may be objected that this is physiological rather than morphological, and that the facial wall of the orbit is sometimes lost in mutilated skulls. It is to be hoped that a careful comparison of many crania may afford some determination of the correlation between the orbital axis and purely cranial planes or points. Dr. Allen's proposition should be tested, but it seems to me somewhat complex, and difficult of exact application.

*Surgeons do not hesitate to determine points on the skin for incisions by the position of the left index finger in abscess cavities, the rectum, or in any other concealed recess or chamber of the body: the tip of the left index finger is used as a surface towards which the point of the knife is directed. The recommendation in the text is based upon this well-known dictum in surgical practice.

"METHODS OF ESTIMATING THE HEIGHT FROM PARTS OF THE SKELETON," BY DR. DWIGHT.

[To be published.]

Dr. Dwight said that in this paper he discussed this question as applied to individuals, chiefly for medico-legal purposes, rather than to races.

There are two methods, the anatomical and the mathematical. The former consists in putting the bones into proper position, making due allowance for the soft parts and then in measuring the height. The first question is to arrange the vertebrae correctly. Instead of discussing the proportion of disc to bone, in each region, it is more simple to know the proportionate length of each region.

Tables were given which had been obtained by original measurements in the dissecting room. Figures showing the amount to be added for the soft parts did not differ greatly from Topinard's recommendation of 3.5 cm. When the anatomical method cannot be followed we must have recourse to the mathematical, which consists in estimating the height from the long bones or from the spine. Topinard, Rollet and Manouvrier have given methods of reckoning from the long bones, and Dr. Dwight had devised one from the spine. He showed tables from 20 male and 20 female white bodies, in each of which the height had been calculated from the long bones according to Topinard, Rollet and Manouvrier, respectively, and in 17 of each from the spine. Roughly speaking, by any method, about half the results were within 2.5 cm. of the height, and three-quarters within 5 cm., which leaves one-quarter in which the error was serious. Methods were then given for correctly placing the spine, when the legs were present but the pelvis wanting. The problem is to know the height of the promontory above the great trochanter, which may be considered about 10.5 cm. in either sex. There would seem to be no reason why, when all the bones are present the error should ever reach 5 cm., were it not that the true height is an uncertain and variable quantity.

Mr. Lucas said that the range of variation in the only bird (*impennis*) he had worked over carefully in respect to variations about 20 per cent., *i. e.*, 10 per cent. on either side of range of the great majority of specimens. Dr. Merriam told him that he had found practically the same range in als.

Wilder expressed his admiration for the learning, accu-

racy and labor involved in the paper and the accompanying tables. He believed the thoracic region of the spine to be least variable and most likely to be preserved with imperfect skeletons; hence it is most available as a unit for the determination of the height.

Dr. Dwight's paper was also discussed by Drs. Lamb, Shute, Gill, Baker and Allen, but no abstracts of their remarks have been received.

"PERINEUM AND PERINEAL BODY," BY DR. D. K. SHUTE, COLUMBIAN UNIVERSITY, WASHINGTON, D. C.

No abstract sent on account of Dr. Shute's illness.

"A STUDY OF THE MUSCULAR TUNIC OF THE LARGE AND SMALL INTESTINE OF MAN IN THE VICINITY OF THE CÆCUM," BY DR. ROBERT ORTON MOODY, NEW HAVEN, CONN.

[To be published in the Proceedings of the American Microscopical Society for 1894.]

The variations in the descriptions of the muscular tunic of the intestines of man, as given by different anatomists, indicate the need of further study of this tunic, particularly in that region where the tunic passes from one intestine to the other.

My own study leads me to believe that all of the varying conditions of structure and arrangement described may have been found by different observers, but that their descriptions are based upon the study of an insufficient number of specimens.

Specimens taken from five adults were prepared by maceration, and the course and relation of their muscular layers were traced by dissection under a simple microscope.

These specimens showed much variation in the thickness, arrangement and relation of the muscular coat. The variation in thickness was most noticeable on the large intestine, where, in some specimens, both layers were so thin as to be deficient in some places, while in other specimens both layers are well developed.

The fibers of the longitudinal muscular layer of the ileum, either attenuated and disappeared or passed uninterruptedly onto the large intestine, to mingle in some manner, either with the fibers of one of the longitudinal bands, or with the fibers of the circular muscular layer of the large intestine. Whether the fibers from the ileum lost themselves upon or between or became

continuous with the fibers of the large intestine was not determined. In only one specimen did any of the fibers of this layer of the ileum pass to any other band than the left longitudinal band of the colon.

The circular muscular layer of the ileum attenuated somewhat as it approached the large intestine and entered into the formation of the ileo-cæcal valve. In three specimens, none of the fibers of this layer of the ileum passed onto the large intestine, but in two specimens, some of the fibers of this layer of the ileum, near its insertion into the large intestine, did pass onto the large intestine and mingled with the fibers of its circular muscular layer, apparently in the same manner in which the fibers of the longitudinal layer of the ileum mingled with the fibers of the longitudinal muscular band of the colon.

The longitudinal muscular layer of the cæcum, in four specimens, formed, like the longitudinal layer of the small intestine, a complete, continuous, well developed investment, but with distinct thickenings to form either two or three longitudinal bands. In two specimens there were only two longitudinal bands on the cæcum, the left lateral band being absent. In the other three specimens the left longitudinal band on the cæcum was very narrow, only a small part of the fibers of the left lateral band of the colon passing onto the cæcum.

In regard to whether the longitudinal muscular layer of the colon forms a complete, continuous investment, observations were not made, except in one specimen, where it did form such an investment as far as the descending colon.

The three well defined longitudinal muscular bands were present on the colon in all specimens. These bands differed in breadth on the same specimen and on different specimens, the left lateral band usually being narrowest. The fibers of these longitudinal bands were arranged as follows: some of the fibers continued directly over the cæcum onto the appendix, some arched across the end of the cæcum, just cephalad of the proximal end of the appendix, and appeared to be continuous with the fibers of the other two bands, some turned and mingled with the fibers of the circular muscular layer in a similar manner to that in which the longitudinal fibers of the ileum mingled with the fibers of the circular muscular layer of the large intestine. Some

ers of the left longitudinal band, in each specimen, interruptedly onto the ileum and appeared to be continuous with the fibers of the longitudinal muscular layer of the

cat and the dog, in which the large intestine is not sac-

culated and in which the ectal longitudinal layer forms a complete, continuous investment, as in the small intestine, there is a similar variation in the arrangement and relation of the fibers of the muscular tunic as they pass from one intestine to the other.

On four of the five specimens, at the insertion of the ileum into the large intestine, was a thick, circular band of muscular fibers, five to ten millimeters wide, which seemed to serve the purpose of strengthening the insertion of the ileum into the large intestine. So far as I know, this band has never before been described. In the other specimen it may have been present and been overlooked.

The sacculi of the large intestine lie entirely between the three longitudinal bands, and do not continue underneath them, so that those portions of the layers of the wall of the large intestine underneath the longitudinal bands must be of the same length as the bands themselves. From the experiments made it appears that this sacculation of the large intestine cannot be entirely accounted for, as is usually done by anatomists, by a difference in length between the longitudinal muscular bands and the other layers of the wall of the large intestine.

The sacculation of the large intestine, and the thickening of its longitudinal muscular layer to form the three longitudinal bands, are seen in foetal life as early as the twenty-fifth week.

By this study another step has been taken toward the determination of the typical structure and relations of the muscular tunic of the intestine of man, but the examination of a much larger number of specimens is needed to fully establish the type or types of structure, relation and arrangement of this tunic.

Dr. Heitzmann said: Several weeks ago Dr. Danforth, of New York, brought me a number of shreds of the length and breadth of a finger, which a patient of his had pulled out of his rectum during defecation. The patient is a careful eater, and had not been seriously ill. Upon examination I found on several shreds the well-known muscle bands, which fact at once suggested the idea that the shreds were portions of the wall of the colon. The shreds under the microscope exhibited the distribution of intestinal muscle layers, as described by the essayist, the mucosa being sloughed away. Evidently a heavy fibroma had formed somewhere in the wall of the colon that dragged down a portion of the wall. The pedicle being supplied with adjacent peritoneal surfaces, healed after the sloughing of the pending portion, without causing general peritonitis.

Dr. Wilder expressed his interest in this paper by his former

student, and suggested that an instructive basis for an extended investigation of the subject from the comparative standpoint would be an accurate determination of the conditions in the raccoon, bear and other carnivora where no cecum is developed, and the two portions of the intestine are less differentiated at their junction.

Dr. Harrison Allen spoke of the abrupt change in the proportions of the small and the large intestine being associated with lack of uniformity of arrangements of the fascicles of the muscular coat in the cæcum. It would appear that the ranges of variation are greater than are met with generally in musculatures. It would be of interest to show the exact connection existing between these variations and the details attending the evolution of the large intestine from the small.

"A NOTE ON THE OCCURRENCE OF THE SCAPULO-CLAVICULAR MUSCLE." BY DR. MOODY.

Last year, while dissecting the left shoulder of a male subject, I found this anomalous muscle, the scapulo-clavicular.

A careful study of the literature on the subject of muscular anomalies revealed the fact that the recognized occurrence of this muscle is very rare. I could discover no record which showed that the muscle had ever been found in this country.

Testut, in his work entitled "*Les Anomalies Musculaires Chez l'Homme*," describes its occurrence in two subjects. He says it has also been described by Wood and Gruber, and that its occurrence has been noted by Luschka, MacWhinnie and Hallet. So careful an observer as Macalister declares that he has never found it.

The scapulo-clavicular muscle is an incomplete form of the sterno-scapular muscle, which, anomalous in man, is constant in many species of vertebrates, reaching its highest development in the pachyderms and ruminants, notably the hippopotamus, the elephant, the pig, the donkey and the horse.

If the clavicular attachment of the scapulo-clavicular muscle were prolonged a few centimeters mesad (toward the median line), its insertion would become sternal or costal, and the muscle would then be a complete form of the sterno-scapular.

Muscles homologous to the scapulo-clavicular muscle in man are found in a large number of mammals. Wood has found this muscle well marked in the rabbit and the guinea pig. Cuvier and Lorillard have figured it in their atlas under the name of "scapulo-clavien."

The muscle which I found was seven centimeters in length. Its diameter in its fleshy portion was about the same as the diameter of the fleshy portion of the posterior belly of the omohyoid muscle in that subject. It took its origin from the superior border of the scapula by a tendinous margin, in common with the attachment of the internal portion of the posterior belly of the omohyoid, and by a slender tendon, which was contiguous with this tendinous margin, and which extended mesad to within one centimeter of the superior angle of the scapula. In its scapular two-thirds, it was internal to and parallel with the posterior belly of the omohyoid. At the junction of the scapular two-thirds with the clavicular third, it passed beneath the omohyoid muscle and continued parallel with the posterior surface of the clavicle to be inserted by a well marked tendon into the clavicle at the junction of the posterior border with the rhomboid impression.

It is in relation dorsad, or internally, with the suprascapular artery and nerve, the serratus magnus muscle, the axillary artery and vein and the brachial plexus; superficially, with the omohyoid muscle and the clavicle.

Dr. Harrison Allen saw no objection to the scapulo-sternal muscle being considered as an upward (cephalad) extension of the serratus magnus.

The two papers of Dr. Moody were also discussed by Dr. Baker, but no abstract of his remarks has been received.

"WHAT GROUND SHOULD BE COVERED IN THE ANATOMICAL COURSE IN AMERICAN MEDICAL COLLEGES? AND WHAT PART OF THIS GROUND SHOULD BE COVERED IN THE *FIRST* YEAR; WHAT IN THE *SECOND*?" BY DR. ARTHUR DEAN BEVAN, RUSH MEDICAL COLLEGE, CHICAGO.

During the last ten years there has been a revolution in the teaching of medicine in America. Ten years ago the majority of our medical colleges required from their students but two courses of lectures, each course covering five or six months. Some of our best schools now require four years work; the term has been increased to eight or ten months.

It is not prophecy to state that within a short time the four year requirement will be generally adopted. When this is done our American medical students will put in more months of work in their medical course than do the German students.

This evolution in the teaching of medicine has necessitated a rearrangement in the methods employed.

In the old two year courses the teaching of each branch was the repetition year after year of the same course of lectures, and the effort was made to cover each subject in one year; with the increased length of term and course the graded system is being, and must be eventually, generally adopted.

The present is a transition period. Even among the better schools working under the graded system there is a woeful lack of uniformity in the methods of handling the various subjects. This lack of uniformity is unfortunate because many students take their first year or two at one school and graduate at some other institution.

This subject forces itself upon all teachers of anatomy. Students present themselves from other schools bringing a certificate showing that they have passed satisfactorily an examination in their first year's work on anatomy. This may mean one of several things; either that they have covered the entire ground in a text book, such as Gray or Morris, or possibly that they have been over the bones and joints and muscles; or any amount of work between these extremes.

The time has certainly arrived when at least an approximately uniform method of studying the subject of anatomy should be adopted by American medical colleges.

This association can wield a powerful influence in bringing about this desired result.

What ground should be covered in the anatomical work of American medical schools? and secondly What part of this ground should be covered in the first year and what in the second? In answer to these questions I submit the following:

First. The anatomical work in a medical school should be limited to human anatomy. The function of a medical school is to educate men to practice medicine and surgery. The limited time which can be devoted to the study of anatomy is none too long to permit even the best student to obtain a working knowledge of practical human anatomy. Zoölogy, comparative anatomy, etc., are of great value to the medical student, but they should form a part of his studies preparatory to studying medicine and should not be crowded into the medical course to the detriment of practical human anatomy.

Embryology and histology, it is believed, should be taught in the laboratory and as a special department.

Second. The first year's work should cover systematic anatomy, osteology, arthrology, myology, angiology and nerves.

The second year, regional and surgical anatomy ; brain and cord ; thoracic and abdominal viscera ; external genitals and organs of sense.

There can be no doubt but that the most profitable method of teaching anatomy is the dissecting-room teaching of regional anatomy. It is found, however, in the practical working of this method that it is very difficult for the student to master the subject thus presented unless he has previously studied systematic anatomy.

To accomplish, therefore, the best results in two years work, it would seem that the method to adopt is the teaching of the systems the first year and regional anatomy the second. In this way the second year's work is largely a repetition of the first, but presented in a more practical and attractive way.

I present this scheme as a suggestion ; of greater value than any special division is the agreement upon some definite plan and its general adoption.

This subject impresses me as one of great importance. If it is thought of sufficient importance by other members of the association, and if it is believed to be within the scope of our work, I would suggest that the association, either as a body or acting through a committee, formulate a scheme outlining the work to be covered in an anatomical course, and the division of this ground into two years of work, and that this association urge the adoption of such scheme by all American medical schools.

"THEORETICAL ANATOMY OF THE SYMPATHETIC SYSTEM," BY
DR. W. P. CARR, COLUMBIAN UNIVERSITY, WASHINGTON.

Examination of the primary sympathetic ganglia by the side of the cord shows comparatively few fibers of communication with the cord and a much greater number of fibers of distribution.

Some of the fibers of communication are ascending, and some descending. The ascending fibers are perhaps ordinary sensory fibers taking this route from the periphery to center. I leave them out of consideration for the present. The descending fibers from the cord must terminate in the ganglia, as we know the ganglia to be influenced by the spinal centers, and the cells of the ganglia could not be influenced by nerve fibers simply passing between them, to be continued on in peripheral nerves.

If these fibers terminate in the ganglia, they must terminate in some form of nerve cell ; for no nerve fiber ever ends abruptly, and if there were any other terminal conformation than the so-

called cell the microscope would show it. Every nerve fiber must originate in a nerve cell or nerve corpuscle, and terminate either in a cell or corpuscle, except at the periphery where they terminate in muscle, gland cells, tactile corpuscles, or some special terminal conformation. A nerve fiber, with its cells at each end and the fine processes passing off from these cells, is a physiological unit, whose life and existence depend upon one of its cells which we may call its trophic and generative cell. Any part of the unit, cut off from this trophic cell will die. Destruction of the trophic cell results in death and degeneration of the whole unit.

Nerve units may be divided into central, intermediate and terminal units. The terminal units begin in nerve cells but end in muscle fibers, or in gland cells, or some form of terminal corpuscle.

The life of the gland cell or muscle fiber depends upon the trophic cell at the other end of the unit, and is, therefore, a part of the unit. We might call these neuro-muscular units, and they are quite similar to the neuro-muscular cells of the Hydra.

Nerve units communicate with each other by means of the interlacing of fine processes of the cells at their extremities.

If we accept these facts, as I think we must, then we are in a position to give a rational explanation of the mechanism of the sympathetic system. It is not a separate system, but a part of the cerebro-spinal axis, and consists of a number of nerve units, originating in the cord and passing to ganglia where each transmits the spinal influence to a large number of intermediate or terminal units.

The sympathetic ganglion is a collection of trophic and generative cells, charged with nerve force ready to be discharged by an impulse brought to it from, perhaps, a single cell in the cord; and that cell in the cord is connected by another nerve unit with the brain, and by another, or by a chain of units, with the periphery, and the discharge of its impulse to the ganglion is thus under control of some brain center, or of reflex influence from the periphery. Thus we have in the ganglion a means of vastly multiplying and distributing a nerve impulse originating in some center in the cord.

Physiological experiments prove that the cells of sympathetic do not voluntarily discharge nerve force, but that they are able to be discharged only under impulse from the brain, or direct mechanical, chemical, or electric stimulation. Attempts to isolate ganglia from the cord have been failures; and there are so many channels of communication that it is

impossible to cut them all without cutting the ganglia entirely out of the body.

Fibers come directly from the cord; others come through ganglia, above or below; others, through the vagus, and others through branches of spinal nerves. We may say, then, that the sympathetic has no function, except its trophic function, that it does not derive from the cord; but that it is a powerful multiplier and distributor of spinal impulse, and, in case of destruction of the spinal centers or severance of connection with the spinal centers, the sympathetic cells may imperfectly continue the function under direct stimulation. Thus after section of the vagus, secretion and motion in the stomach cease, as long as the stomach is empty, but can be partially restored by the direct stimulation of food upon the cells in Auerbach's and Meissner's plexuses.

Many of the fibers pass from the primary ganglia to secondary ganglia, and the spinal impulse may be multiplied by two or three or four ganglia before reaching the periphery. This, perhaps, takes some time, and accounts for the slow response to stimuli in the smooth muscle fibers, and explains why we have no such multiplying arrangement in nerves supplying striped muscle where we want quick action, and where we find a single nerve unit stretching from the anterior horns of the gray matter of the cord to the muscle fiber.

Here we have the trophic cells of the muscle fibers concentrated in the cord, and consequently we see, as a result of anterior cord lesions, degeneration of large masses of voluntary muscle. Should this occur in involuntary muscle of the heart or stomach, death would be the result. Hence, as a protection, we have the trophic cells of the muscles of the vital organs widely distributed, so that no ordinary lesion can affect more than a few, and such a network of communication with the cord as to render it impossible to destroy the connection.

Dr. Baker remarked that the existence of a continuous fibrillary plexus in the nervous centers as described by Gerlach is thought to be thoroughly disproved by recent investigations made by the most competent and experienced histologists, such as Kölliker, Waldeyer, Ramon y Cajal, van Gehuchten, Lenhossek and many others. These investigators do not rely solely upon the Golgi method, but use Ehrlich's *intra vitam* staining and other methods also.

This separation is exactly what might be expected when we consider the fibrils as processes of nerve-cells. Here, as else-

where in the human body, each cell is a separate structural entity anatomically distinct from all others.

This does not in any way prevent the accumulation of force described by the author of the essay. It rather makes the *modus operandi* clearer, as it makes it possible for us to conceive of one cell setting in action many others by means of the extensive ramification of its processes.

Dr. Heitzmann said: The views laid down by the essayist are in accord with my own observations. He justly speaks of a multiplication of the "nerve-force" within a sympathetic ganglion, which, with me, would be an extended contraction of the reticulum of the living matter, similar in action and result with an electric accumulator. The transmission and multiplication of the nerve-action becomes explicable only, if we admit a continuity of the reticulum in the gray nerve-substance, contrary to the views of Waldeyer, who claims a tree-like ramification of each region of a ganglionic corpuscle, for which tree he proposes the term *neuron*. Golgi's method will never bring forth the continuity, since the silver-salt is merely precipitated upon the minutest fibrillæ of the living or contractile matter. Perfect insulation within the nerve-centers in my conviction does not exist.

Dr. Carr, in closing the discussion, said that he did not believe in the existence of a continuous fibrillary plexus as might be implied by Dr. Baker's remarks; but thought the various nerve units communicate by the interlacing and simple contact of fibrillary processes of one cell with those of another cell.

"THE TERMINOLOGY OF THE NERVE CELL," BY PROF. P. A. FISH, CORNELL UNIVERSITY.

[To be published in the Journal of Comparative Neurology, Sept. or Oct., 1894.]

The recent discoveries in the histology of the central nervous system have involved to a greater or less extent the introduction of new terms and the rearrangement of old ones; and, although on account of an insufficiency of words repetition may be necessary, the terms selected ought to be far enough removed from their original use to prevent any misapprehension in their new application.

For the equivalent of a nerve unit (the cell with its appendages) the term *neurocyte* is suggested. It correlates very well with a *leucocyte*, and is somewhat analogous in form if we consider the processes of the nerve cell as comparable to the pseu-

dopodia of a white blood corpuscle long drawn out and fixed in position.

As a convenient correlative, *spongiocyte* may be used for the glia or neuroglia cell. There is no inherent objection in retaining the prefix of the term applied to the embryonic cell; for in the adult there is still an analogy, more or less modified, to the earlier condition.

Neuron has been used to designate so many different parts of the nervous system, that its continued use, at least in histology, would tend to make confusion worse confounded. It has been applied (chronologically) to the nervure or vein of an insect's wing; to a certain part of the eye of some invertebrates; to the cerebro-spinal axis; to the nerve cell as an unit; to the axis-cylinder process of the cell, and, lastly, to the physiologically differentiated fiber tracts or columns of the myel. For the axis-cylinder process the word *neurite* is suggested, (Raubert, 1894, independently uses *neurit*, and replaces *neuron* by *neura*.) and for the other processes retain the term *dendrites*.

"THE FORM AND RELATIONS OF THE NERVE CELLS AND FIBERS IN DESMOGNATHUS FUSCA." PROF. FISH.

[Published in the Anatomischer Anzeiger, August 11, 1894.]

The neuraxis of the *Desmognathus* consists of an ental cellular layer or entocinerea and an ectal layer of fibers or alba. The ental boundary of the cellular layer is comprised of a single layer of endymal cells, sending their long processes to the periphery. At the ectal boundary of the entocinerea the cells approximate to the fusiform type, they are undoubtedly nervous, and are characterized by more than one process.

Between the endymal cells and the fusiform cells, intermediate forms are found. These have but a single process of greater or less length, according to their distance from the alba. The process divides at the alba or just entad of it at an angle of 90° or 180°, and may be called a neuro dendrite. In some favorable specimens a finer and longer process was seen arising from one of the dendrites and probably represented a neurite (axis-cylinder).

In the spinal ganglia three distinct peripheral nerve trunks were noticed. The first and largest corresponds to the single ventral trunk commonly found. The second may be known as the latero-caudal trunk. As indicated by its name it passes in

an oblique direction to supply the sides of the body. The third is the dorsal trunk and extends directly dorsad. All three possess dorsal root (afferent) fibers and ventral root (efferent) fibers.

"THE FEMALE EXTERNAL GENITAL ORGANS; A CRITICISM ON CURRENT ANATOMICAL DESCRIPTION," BY DR. D. S. LAMB, ARMY MEDICAL MUSEUM, WASHINGTON.

[Published in the New York Journal of Gynecology and Obstetrics, August, 1894, p. 105.]

It is necessary to study anatomy, especially for clinical purposes, from the living subject. Anatomical descriptions to prevent confusion should be made from the body as if it were in the vertical position.

The labia majora and minora are not covered with mucous membrane as generally stated, but with integument; because they have no mucous glands, but instead have sebaceous and sweat glands; pigmentation and hair; vascular papillæ; and stratified squamous epithelium, which is non-nucleated in its surface layers.

The covering of the glans clitoris is integumentary and not mucous membrane. The line separating the integument and mucous membrane may be set down as the dividing line between the upper or inner border of the labia minora and the vestibule and hymen.

The mucous glands of the vestibule are mainly collected in one place, namely around the orifice of the urethra.

There are probably no mucous glands in the hymen; its surface characters are rather integumentary.

The anterior and posterior commissures of the vulva (or of the labia majora) are for the most part imaginary.

The fourchette is the posterior commissure of the labia *minora*.

The paper was discussed by Drs. Moody, Gerrish, Carr, Baker and Dickinson. No abstracts received from Drs. Carr and Baker.

body said: The confusion in the description of the ex-nale genitals, mentioned by Dr. Lamb, which arises from rption being made, with the subject sometimes standing etimes reclining, might be avoided by using the terms

cephalad, caudad, ventrad and dorsad, so strongly advocated by Dr. Wilder.

Dr. Fred. Gerrish, of Bowdoin College, stated that as adhesions could not occur between two intact mucous surfaces, such adhesions proved the covering of the clitoris and the lining of the prepuce to be skin.

Dr. R. L. Dickinson (Brooklyn) plead for an English nomenclature; cited diseased conditions, showing the dividing line between skin and mucous membrane to be clearly as claimed by Dr. Lamb, and spoke of its distinctness in some masturbators, and said his accumulating statistics are showing that, as in boys, the female prepuce at birth is generally adherent, with frequent accumulations of secretion.

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Total: 107 active, 3 honorary.

PROCEEDINGS
OF THE
SEVENTH ANNUAL SESSION
OF THE
Association
of
American Anatomists,

Held in New York City, December 28 and 29, 1894.

TO WHICH IS APPENDED A

LIST OF MEMBERS.



WASHINGTON, D. C.
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1895.

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PROCEEDINGS OF THE SEVENTH ANNUAL SESSION.

The seventh annual session of the Association was held in the Medical Department of Columbia College, 437 West Fifty-ninth Street, New York City, December 28 and 29, 1894.

The Association was called to order Friday, December 28th, by the President, Dr. Thomas Dwight, in a few introductory remarks.

The following officers and members were present during the meeting: the President, Dr. Dwight; Vice-Presidents Wilder and Shepherd; Secretary and Treasurer Lamb; of the Executive Committee, Drs. Spitzka and Gerrish, and the *ex officio* members; Allen, Baker, Dwight and Wilder of Committee on Anatomical Nomenclature; and Bevan, Boshier, Ferris, Hamann, Heitzmann, C. J. Herrick, Huntington, Moody and Weisse; total, 17.

The report of the Secretary and Treasurer was read and accepted. It covered the six months which had elapsed from the sixth session, held at Washington, D. C., May 29 to June 1, 1894. The following are extracts:

"Sometime after the adjournment of the session, I was informed that our fellow member, Dr. A. C. W. Beecher, late Demonstrator of Anatomy, Jefferson Medical College, Philadelphia, had died November 7, 1893.

"Dr. Middleton Michel, Professor of Physiology, Medical College of South Carolina, died June 4th, 1894.

"Dr. H. M. Biggs, Professor of *Matéria Medica*, Therapeutics, Clinical Medicine and Pathological Anatomy, Bellevue Hospital Medical College, New York City, resigned November 3d, on account of other and urgent duties.

"Dr. G. Hudson Makuen, Assistant Demonstrator of Anatomy, Jefferson Medical College, resigned December 18th.

"The financial exhibit is as follows:

Receipts.

Balance on hand, May 29, 1894,	\$146.80	
Received for dues,	171.00	
	<hr/>	\$317.80

Expenses.

Printing and stationery,	\$120.40	
Postage and express,	24.75	
Typewriting and copying,	8.00	
Sundries, . . . . .	.75	
	<hr/>	\$153.90

Balance on hand, December 28, 1894, . . . \$163.90

"The arrears for dues amount to \$182.00, divided up as follows: 21 members owe for *one* year; 11 for *two* years; 5 for *three* years; 3 for *four* years; 3 for *five* years; 1 for *six* years. At the last meeting, an amendment to Section 9 of the Constitution was adopted, providing that 'members in arrears for dues for two years shall be dropped by the Secretary at the next succeeding meeting of the Association, but may be restored on payment of arrears, at the discretion of the Executive Committee.'"

With regard to the proposed affiliation with the Society of Naturalists, the Association decided that at present it could only agree to meet, as a rule, at the same time and place as the Naturalists.

Dr. Wilder, of the Committee on Anatomical Nomenclature, reported progress. The resignation of Prof. Stowell, from this committee, was received and accepted, and the President appointed Dr. Gerrish to fill the vacancy.

Dr. Dwight, of the Committee on Anatomical Material, reported progress. Dr. Lamb, of the Committee on Anatomical Peculiarities of the Negro, also reported progress.

Dr. Huntington was elected to the vacancy on the Executive Committee caused by the retirement of Dr. Spitzka.

The Auditing Committee, consisting of Drs. Baker and Ferris, reported the accounts of the Treasurer correct.

The following new members were elected: Brockway, Brooks, Dexter, Gallaudet, Gregory, Herrick, Hunt, Hutchinson, Mathews, Smith and Tupper; total, eleven. (See p. 31.)

In accordance with amendment to Section 9 of the Constitution, the following names were dropped for non-payment of dues: Baur, Clevenger, Gray, Harger, Huidekoper, Miller, Norris, Sudduth, Tuttle, Williston and Wright; total, eleven.

The following papers were read and discussed: (See p. 8, *et seq.*)

Dr. Huntington kindly showed the members through the rooms of the Medical Department of Columbia College on the evening of December 28th.

Just before adjournment the usual votes of thanks were given; and especially a vote of thanks to the College and Dr. Huntington for their hospitality.

An abstract of these proceedings was published in the New York "Medical Record," January 26, 1895, p. 115, and in "Science," March 15, 1895, p. 297.

CONSTITUTION.

SECTION 1. The name of the society shall be the "Association of American Anatomists."

SEC. 2. The Association shall have for its object the advancement of the anatomical sciences.

SEC. 3. The officers of the Association shall consist of a President, two Vice Presidents and a Secretary, who shall also act as Treasurer.

SEC. 4. The officers shall be elected by ballot every two years.

SEC. 5. The management of the affairs of the Association shall be delegated to an Executive Committee, consisting of its President, Secretary and three other members.

SEC. 6. One member of the Executive Committee, shall be elected annually.

SEC. 7. The Association shall meet annually, the time and place to be determined by the Executive Committee.

SEC. 8. Candidates shall be proposed in writing to the Executive Committee by a member. Each proposal shall be made at or before the first session of any regular meeting of the Association. The proposal shall state the official position or occupation of the candidate and the character of his investigations. The election shall take place by ballot in open meeting, a two thirds vote being necessary. Honorary members may be elected from those, not Americans, who have distinguished themselves in anatomical research.

SEC. 9. The annual dues shall be two dollars. A member in arrears for dues for two years shall be dropped by the Secretary at the next succeeding meeting of the Association, but may be restored on payment of arrears, at the discretion of the Executive Committee.

SEC. 10. The rulings of the Chairman shall be in accordance **Robert's Rules of Order."**

11. Five members shall constitute a quorum for the on of business.

OFFICERS FOR THE YEARS 1894-'95.

DR. THOMAS DWIGHT, of Boston, Mass.,	-	-	-	-	President.
DR. B. G. WILDER, of Ithaca, N. Y.,	-	-	-	-	First Vice President.
DR. F. J. SHEPHERD, of Montreal, Canada,	-	-	-	-	Second Vice President.
DR. D. S. LAMB, of Washington, D. C.,	-	-	-	-	Secretary and Treasurer.

DELEGATE TO AMERICAN CONGRESS OF PHYSICIANS AND SURGEONS.

PROF. C. L. HERRICK, of Granville, Ohio.

ALTERNATE.

DR. D. K. SHUTE, of Washington, D. C.

EXECUTIVE COMMITTEE.

DR. F. H. GERRISH, of Portland, Me.
 DR. THEODORE N. GILL, of Washington, D. C.
 DR. GEO. S. HUNTINGTON, of New York City.
and the
 PRESIDENT and SECRETARY, *ex officio*.

COMMITTEE ON ANATOMICAL NOMENCLATURE.

DR. HARRISON ALLEN, of Philadelphia.
 DR. FRANK BAKER, of Washington.
 DR. THOMAS DWIGHT, of Boston.
 DR. F. H. GERRISH, of Portland, Me.
 DR. BURT G. WILDER, of Ithaca, *Secretary*.

PAPERS READ AT THE SEVENTH SESSION.

FIRST.—“THE BEST ORDER OF TOPICS IN A TWO YEARS’ COURSE OF ANATOMY IN A MEDICAL SCHOOL.” DR. GERRISH.

[Published in “Science,” March 22, 1895.]

Teachers of anatomy differ so widely in their views as to the most useful arrangement of the various branches of the subject that it is desirable to clear the field as far as possible at the very beginning of our discussion by the elimination of those points upon which there is substantial agreement. I assume that there is no diversity of opinion on the places which should be occupied by histology and topography. It is to my mind perfectly manifest that the student cannot profitably or comfortably receive instruction in gross anatomy until he has learned the elements of histology; has become familiar with the characters of the various textures which make up the parts and organs of the body, and to which, of necessity, references are constantly made in macroscopic anatomy. By identically the same method of reasoning the conclusion is reached that topography should be taken up latest of all; for it cannot be in a high degree useful to the pupil to work at the relations in space which different organs sustain to each other, until he has acquainted himself with the facts of their shape, size and consistency. To attempt descriptive anatomy without histological knowledge is comparable to studying architectural structures in perfect ignorance of the qualities of building materials, such as stone, brick, wood, iron and mortar; and to undertake regional, before being well grounded in systematic, anatomy is about as possible as reading sentences before acquiring words, or studying the relations of any other things without knowing something about the things themselves. Besides, there is a marked advantage in the incidental, but searching, review of every preceding portion of gross anatomy involved in the pursuit of topographical; and all teachers recognize the vast importance of such repetitions for the student, even if they do not admit that they themselves retain their familiarity with
of innumerable details only by virtue of incessant
e way or another.
certainly room for difference of opinion concerning

the most advantageous marshaling of the remainder of the topics with which we have to deal; but our decision should probably be in largest measure determined by the circumstances in which it is necessary to pursue the study. If the pupil is to devote himself to anatomy only, no great objection is to be raised to the order of subjects adopted in the text-books in most common use—the order which, I think, the majority of teachers employ—beginning with osteology, and following in regular succession with arthrology, myology, angiology, neurology and splanchnology. Much can be said in support of this arrangement. The knowledge of vessels, their origins and terminations, can be of little avail, if there is not a precedent acquaintance with the muscles and other structures which they flush with nourishing blood, or drain of unneeded and effete material; and, so, before undertaking angiology, we need especially to study muscles, which constitute so large a part of the human bulk outside of the great cavities, and in which are found so considerable a proportion of the tubes of supply and waste with which we have to deal in the practice of medicine and surgery. The nerves, too, cannot be studied to advantage without antecedent familiarity with the muscles, which are the objective point of their motorial function. In their turn, also, the active organs of locomotion are never learned unless there is a well laid foundation of skeletal knowledge, upon which to build them; for in absence of this basis, they are but impotent, flabby, almost shapeless masses of flesh, but little amenable to description, and quite elusive of comprehension. Arthrology is plainly out of the question without osteology, which should immediately precede it. The study of the viscera and organs of special sense concludes the series.

This arrangement is not altogether free from objections. For instance, even after one knows the skeleton and the muscles clothing it, he finds in his study of the arteries much that he cannot fully comprehend from lack of acquaintance with the viscera. But no method can be absolutely perfect. One needs to know all of his anatomy—the whole of everything—in order to understand any one organ perfectly. The problem, therefore, for us, as teachers, is to discover that plan which reduces to the minimum this necessity of knowing a good deal of every department of our great science before entering upon the study of any one of them; and particularly the scheme which makes this need least conspicuous in the earlier portion of the course, when everything is new; for, since the growth of one's anatomical knowledge makes further acquisition in the same line progressively easier day by day, because he is all the time getting nearer to the goal

of knowledge of the whole, the last part of the course is naturally that in which there is the least occasion for such help as can be derived from a wise order of topics. After all, however, the arrangement in question is useful ; perhaps as good as any other, provided that there is an observance of the condition which I have attached to my commendation of it ; but without this provision it seems to me to be clumsy, obstructive, wasteful and irrational.

The condition is that the student is attempting nothing else than anatomy. Practically this is a state of affairs which never obtains in the schools, and is not in the least likely to occur ; always physiology is studied synchronously, and usually, also, general chemistry—the latter a branch with no more claim to be regarded as a legitimate topic of medical study than have botany and zoölogy, and, in all fairness to student, school and community, should be required as a preliminary to the medical course. We may confidently count upon finding the first-year student occupied equally with physiology and anatomy. Now, it is so obvious as to require no argument that the action of an organ can never be studied with complete satisfaction until its structure is well understood. Consequently, the anatomy of each part should be learned before its function is presented, in order that the pupil may work intelligently and be spared much difficult and unproductive effort. If the professor of anatomy does not aid him in this matter, the physiologist is driven to perform the task, although it is outside of the proper sphere of his work, and involves the expenditure of much time which he needs for affairs in his own peculiar field. The physiology which we most require is a knowledge of the offices of the viscera, and the teachers of this branch necessarily devote the greater part of their instruction to the consideration of the action of these organs, which, according to the conventional order of topics in the anatomical course, are not touched until all other portions of systematic anatomy have been disposed of. As a result of this, in the early part of the course the anatomist is teaching a vast number of things which are of the smallest possible help to the student of physiology ; and, in almost the last part, he goes over ground which has been traversed long before by a suffering colleague, who has been forced into this unwilling usurpation by the unhappy arrangement of the anatomical schedule. In other words, a large and important **making, the most important) section of anat-**
omy **the professor of this branch at a period**
y required by the student, and is presented
s been already learned.

Surely this state of affairs is, to say the best of it, deplorable, and should not be permitted to continue, if it can be abolished without injustice to the interests of the science to which we dedicate so much of our lives. Each one of us should bear constantly in mind that he is not merely an instructor in a special branch, but is, besides this, a member of a faculty, the purpose of which is to give to medical students the most complete, well-rounded, professional education possible with the available means. On the old lines, which schools have followed far too long, and which are not yet abandoned by all institutions, every professor discoursed to the entire class—a higgledy-piggledly arrangement (perhaps derangement would be the more appropriate designation for so lunatic a scheme) which would not be tolerated for a week in a common school of the lowest grade. Gradually faculties are becoming converted to the idea that a grading of the course is essential to the best results; and those branches which are natural stepping stones to others are completed before advanced studies are undertaken. But much still remains to be done before the most useful system is formulated, and the part of this work which most concerns us is the proper adjustment of our topics to the needs of our colleagues who teach physiology. The plan which I am about to propose is designed especially to attain this end, and will be seen, I trust, to be the most advantageous in other respects also. It is devised in the spirit which should actuate every individual in a body which is formed to accomplish a given purpose; each one is bound not simply to do those things which will make his department a success, but to do them in such a way as to promote the interests of every other chair. There should be perfect coördination in teaching—the faculty should work always as a “team,” if a popular expression may be used. In no other way can the highest results be achieved.

In the first place I would have the anatomist ascertain the exact order of topics in the course of his physiological colleague. Let us suppose that the latter purposes, after a little time spent in necessary preliminary considerations, to conduct his class into the realm of the circulation. The anatomist will precede him by a day or two with the study of the organs by means of which circulation is performed. The structure of the heart will be presented with as much of detail as is requisite for the ready comprehension of its action, and this will be followed by the physiological anatomy of the blood vessels: the materials of which they are composed, the arrangement of these, and the variations in their proportions in the large, medium and small vessels respectively;

the physical qualities of the walls; the style of division and union: how the great arterial trunks branch and divide until the most diminutive twigs terminate in capillaries, and how the venous radicles begin in the midst of the tissues and by successive and innumerable conjunctions form larger tubes until the great tap-roots of the system are reached; in short, all those points which aid in the understanding of the function of these organs. He makes no attempt at this stage of the course to present the systematic anatomy of the arteries and veins; perhaps not a single vessel of the great multitude is called by name, except those which, being attached to the heart, must be specifically designated in order to make the description of that organ intelligible. He does not undertake to describe the relations in space which the heart and principal vessels sustain to the parts by which they are surrounded; for he knows that these relations might be very different without essential modification of their action, and that, therefore, they need not be introduced at this period of the curriculum. Thus, the students are well equipped to receive instruction on the circulation from the professor of physiology, and the latter is free to devote his energies entirely to the work which alone he should be expected to undertake.

This example is no more striking than any other, but it serves well to illustrate on the physiological side the benefits coming from the adoption of the order which I advocate. In this manner the course proceeds; and no portion of the field is entered upon by the physiologist which has not been explored and surveyed, as far as structure is concerned, by the anatomist in company with the same set of pupils. After the study of the viscera, including the cerebro-spinal centers and the organs of special sense, comes the consideration of the remaining branches of systematic anatomy, beginning with the skeleton and proceeding in the conventional order.

That much advantage accrues to the class in physiology by the execution of this plan seems to me to be perfectly clear. That any anatomical sacrifice is made by it I do not believe. On the contrary, a distinct benefit is gained even in anatomy; for the learning of the function of an organ immediately after the study of its structure serves to emphasize and deepen the impression made by the earlier lesson, and quickens with a living interest what otherwise might remain in the mind only as dry and arbitrary facts, if, indeed, it lapse altogether from memory because of its la-

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great profit of a practical kind,
ion order. Students usually

know less about visceral anatomy than about any other section of the science. This comparative ignorance depends upon three causes. The first is the fact that the ordinary text-books are far less accurate in the description of the viscera than in that of other parts; a statement which it is unnecessary to substantiate in this learned presence. Second, the study of the viscera is much more difficult than that of other parts. In their best estate they present appearances which are liable to be misleading even to the most careful and experienced observers, as witness the conspicuous errors which for generations passed muster regarding the form of the liver and the position of the stomach, points still misstated in some of the text-books of the day. But another obstacle is often more serious than this. If the organs are fresh, much that is valuable can be learned from them; but when they are the seat of advanced putrefactive changes, as often happens when the muscles and associated parts are still useful for somewhat prolonged examination, they must be removed speedily, without affording the slightest opportunity for careful observation. Third, as the subject of the viscera is usually placed last in the study of systematic anatomy, it is more likely than anything else to be slighted. We all doubtless know from observation, and some of us probably from personal experience, that the enthusiasm of a novice in a study rarely is sustained to the end. In fact, it may be said, without incurring the imputation of exaggeration, that a large majority of students in any class flag very noticeably towards the close of the term, however eagerly they may have started out. Unquestionably most medical men, young or old, know more about osteology than about any other branch of anatomy. The reasons of this are not far to seek; the skeleton is less perishable than the soft parts, and hence the opportunities for the study of it are vastly greater; and, what seems to me to be of quite as deep significance, it is generally the first branch of our science which the student attacks. It is his memorable first step inside the mighty and mysterious domain of medicine, and, consequently, every detail makes a powerful impression on his plastic mind. Although he sees that his book contains much besides osteology, this is the first, and, by inference, the most important of its contents. The common people sometimes speak of a skeleton as an anatomy; and the young student almost deludes himself with the notion that he knows the bulk of anatomy when he has acquired a very general conception of the bones. Of course, his ideas are silly and childish, and have to be corrected; but we must take human nature as we find it, and, if possible, turn its very weaknesses into useful channels. Now, without having the smallest disposition to belittle the ad-

vantage of an accurate knowledge of the skeleton, it has long been a conviction with me that visceral anatomy should be ranked first in the list of topics, considered from the purely utilitarian point of view; that the subject of which our students generally know least is precisely that of which they ought to know most. They come to us in order to be equipped as practitioners. Whatever may be their callow aspirations, however much they may be dazzled and charmed by the brilliant performances of surgery, we and all of our colleagues know that the enormous majority of them must be general practitioners, doing almost no surgical operations except the strictly minor; having a great many obstetric cases; seeing a multitude of sick infants, a good many ailing women, and not a few acutely ill adults of both sexes. What is the greatest anatomical need of such men? Is it not undeniable that, for one case demanding in them a knowledge of bones, muscles, blood vessels or nerves, they have at least a score in which they must know something definitely about the structure of lungs, heart, stomach, bowels, liver, kidneys, uterus or brain? If, then, visceral anatomy far surpasses all other portions of the field in importance to the enormous majority of practitioners of the healing art, it should be placed first chronologically in the course of systematic anatomy, so that it shall be taught at the time when the learner's mind is most eagerly receptive and most faithfully retentive; provided, of course, that this assignment of position does not conflict with the rights of other things. Unless my argument has utterly miscarried, it is established that the proposed order not only does not sacrifice anything on the physiological side, but is even of conspicuous advantage to it; and I have been unable to discover any way in which it can affect unfavorably the welfare of any department whatsoever. There is no occasion for anxiety lest the postponement of osteology will result in its being ignored or slighted. The facilities for its study are so comparatively abundant, the conventional conception of its importance is so deeply rooted, and the natural and inevitable attraction which it exercises on the student is so strong as to insure the bestowal upon it of a sufficient share of his attention.*

* It would be foolish to disparage the cultivation of any portion of the field of human anatomy; the more thoroughly the physician knows every part of it the better equipped will he be as a practitioner. Vastly more blunders than are ever recognized depend upon the want of knowledge of easily known facts of structure. But the tremendous influence of osteology, which characterizes the method of some of our teachers, is to me to demonstrate a lack of sense of proportion, which, unaided for by the student of medical history, who appreciates the almost domineering influence of habit and suggestion, is the less peculiarly unfortunate in its effect.

With me the order advocated is not merely a theory : it is a long accomplished fact. For about fifteen years I have had the plan in practical operation, and have not yet observed a single thing which has caused me to regret the change from the ancient system. It appears to me now, as in the beginning, to be the most rational, economical, facile, attractive and useful succession of topics. During this prolonged trial of the order I have had as fellow-members of the Bowdoin faculty in the chair of physiology three gentlemen, of whom two, Drs. B. G. Wilder and C. D. Smith, are members of this Association, and can testify as to the usefulness of the plan. The third, Dr. Henry Hastings Hunt, has within a month ceased from his labors, and been borne to his honored grave ; but I feel justified in giving his testimony emphatically in its favor.

My plan, slightly detailed, is as follows : Beginning with some explanations of a general character, and the definition of certain terms which are so technical that the novice cannot be expected to know them, I give the names, both English and Latin, and the limits of extension of all of the superficial parts ; for I have learned that it is not safe to count on anybody's knowing what an anatomist or surgeon means by various terms applied to parts which are visible without dissection, and have vernacular appellations. Histology is then presented in an elementary way, and the student is taught the essential truths about the simple tissues. The different kinds of membranes are discussed, and the structure of glands in general is naturally given the next place. The student is now fairly equipped for the study of the viscera, and these are taken up in whatever order the physiologist of the institution prefers. In one important particular my course at this period differs from visceral anatomy as presented in most of our books : the brain and spinal cord, the noblest and most interesting of all entrails, are included in the company of the viscera, and not, as ordinarily in the text-books, with the nerves. After this come in regular, conventional style the bones, ligaments, muscles, arteries, veins, lymphatics and nerves ; and, last of all, topographical, or as I prefer to call it, relational anatomy.

In this scheme no separate place is assigned to embryology, a subject usually treated in obstetrical and physiological works, as well as in anatomical. By agreement with my colleague in physiology, its systematic presentation is made by him ; but all through my course the facts of development are introduced, not only to inform the student upon points of practical moment, but also to illustrate and enforce many features of adult structure.

At the end of his first year in the school the student is required

to pass a satisfactory examination in histology, splanchnology and osteology, and he is not permitted to enter upon second year studies until he has so passed. At the end of his second year he is examined on the remainder of systematic and all of relational anatomy, failure excluding him from his third year.

It will be observed that I have confined my remarks strictly to the subject announced, and have refrained from discussing the relative merits of various methods of imparting instruction, as by lectures, recitations, demonstrations, and so forth. I wish it to be understood, however, that, if any expression of mine has seemed to imply that the old-time method of teaching by lectures holds the first place in my esteem, I have unwittingly done an injustice to a cherished conviction; for the lecture system, as an exclusive, or even principal, method of instruction, has long seemed to me to be the worst which has been devised.

Dr. Gerrish's paper was discussed by Drs. Huntington, Baker, Wilder, Bevan, Allen, Shepherd, Lamb and Dwight. Abstracts of remarks made by Drs. Shepherd and Lamb have been received.

Dr. Shepherd said that one thing none of the speakers had referred to was the teaching of anatomy in the dissecting room. Now, in his opinion, this was the most important part of a student's training, and the lectures he considered should be merely adjuvants to the dissecting room work. Lectures should be guide posts and should assist the student in understanding the scientific bearings and the continuity of the subject. Here morphology and development could be taught, but for the most part the thorough training of the student in dissecting should be looked upon as much more important than mere lecturing. It was his endeavor to arrange his course so as to fit in with the subjects taken up by the physiologist, but so far he had been only successful in arranging the lectures on the nervous system and the special senses.

His demonstrators were continually giving demonstrations to small classes on the viscera to both first and second year men. He thought before everything the student should first have a good knowledge of osteology, and did not approve of the viscera being first taken up. A knowledge of the framework should be acquired before the contents were attempted. The physiologist could quite well give a short account of the anatomy of the organ before describing its functions, and repetition did not injure the student; on the contrary, it was only by frequent repetition that an im-

pression was made on the mind of the ordinary student. The courses of anatomy and physiology must overlap in many places, and it was good that they should do so. In his university histology was taught separately, so he only took it up incidentally, as he did development.

In conclusion Dr. Shepherd said that there were many good ways of teaching anatomy, but no perfect ones, and what suited one teacher for one class of students would not suit another, and that in teaching, one must suit himself to his surroundings and the exigencies to which he was compelled to submit.

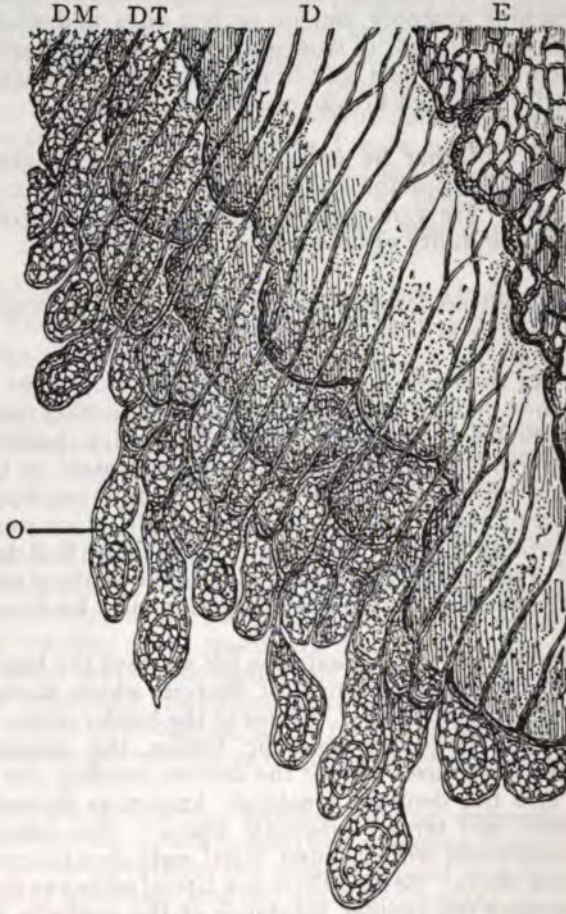
Dr. Lamb said that he coincided with the remarks of Dr. Shepherd. In his opinion the dissecting room was the place to learn anatomy. He agreed also to the view of Dr. Gerrish as to the questionable utility of didactic lectures in anatomy.

SECOND.—“HISTORY OF THE DEVELOPMENT OF DENTINE.” DR. HEITZMANN.

Up to 1852 the dentine was thought to develop from a membrane, the *membrana eboris*. In that year A. Kölliker recognized epithelioid bodies at the boundary of the papilla, bodies which afterwards were termed *odontoblasts*, and recognized as the dentine formers. Kölliker did not know at that time anything about the presence of fibers in the dentinal canaliculi, which were afterwards discovered by John Tomes. In 1862 Franz Boll described offshoots of the odontoblasts running into the dentinal canaliculi as dentinal fibers, laterally to the neighbors and backward into the papilla.

In the sixth month of intrauterine life we have the best opportunity to study the development of dentine, which starts at the end of the fifth foetal month. We see at the border of the already formed dentine large protoplasmic bodies, the odontoblasts, mostly with broad bases toward the dentine, sending one to four offshoots into the dentinal canaliculi, known as formations of living matter, and termed “dentinal fibers.” Not infrequently we see odontoblasts with pointed distal ends directly connected with dentinal fibers. Besides these are lateral offshoots similar to those traversing the cement substance of the epithelia, and offshoots into the myxomatous tissue of the papilla. Nobody could as yet explain how the odontoblasts are transformed into the basis substance of dentine, in which process the beaded fibrillæ, the dentinal fibers, remain unchanged. E. Klein thought that the broad band odontoblasts become the basis substance proper,

whereas the pointed odontoblasts, dubbed by him "Fibril cells," would produce the dentinal fibers. This view is erroneous, since we frequently meet with "fibril cells" at the places of sharp curvatures of the papilla, mainly at its summit, in large numbers whereas they are scanty at the lateral surfaces of the papilla.



First formed dentine of a human fetus of six months. Magnified 1,200 diameters.

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= dentine with marked globular territories.

= a non-calcified basis substance, likewise globular.

= canaliculi before the formation of basis substance.

= roots of which run between the medullary corpuscles into the dentine

C. F. W. Boedecker discovered in my laboratory that shortly before the formation of dentine the distal portions of the odontoblasts break up to embryonal or indifferent corpuscles, all of which remain united by means of delicate offshoots, traversing the interstitial fields. By coalescence of these offshoots originate the dentinal fibrillæ, the embryonal corpuscles themselves being transformed into basis substance, in which the reticulum of living matter, though hidden in the calcified glue-yielding substance, remains unchanged. Thus it was demonstrated that the development of dentine is identical, in all essential features, with that of bone tissue. Frank Abbott has afterward shown that, while the distal ends of the odontoblasts are transformed into dentine, after first having fallen back to an embryonal condition, the proximal ends are super added to by coalescence of embryonal corpuscles. Since John Tomes we know that the odontoblasts are the outcome of coalescence of different corpuscles. This explains why, in the process of formation of dentine, the odontoblasts are always visible in, at least, a single row. After the tooth is fully formed odontoblasts are not seen as regular protoplasmic bodies, but only as rows of indifferent corpuscles.

THIRD.—"ON THE VALUE OF THE NASAL AND ORBITAL INDICES IN ANTHROPOLOGY." DR. ALLEN.

Discussed by Drs. Wilder, Huntington and Dwight.

FOURTH.—"LOOSE CHARACTERIZATIONS OF VERTEBRATE GROUPS IN STANDARD WORKS." DR. WILDER.

The speaker reiterated a criticism implied in 1880*, and distinctly stated in 1885†, viz., among characters that are alleged to distinguish groups from one another, some may really be constant and peculiar, but others constant but not peculiar; others, peculiar but not constant, and others neither peculiar nor constant. A marked instance of this confusion occurs in a recent authoritative English work.

Besides tending to bewilder the student and even mislead the naturalist, Professor Wilder held that this ambiguity, in such marked contrast to mathematic and even linguistic treatises, prevented the recognition of natural science as a means of

* *Amer. Journal of Science*, July, 1880, XIX.

† Educational museums of vertebrates. Address (as vice-president) before the Biological section of the Amer. Assoc. Adv. of Science. *Proceedings of the Association*, XXXIV, 1885, p. 19. Abstract in *Science*, September 11, 1885, pp. 222-224.

mental training and as a requirement for admission to colleges. As a remedy he urged that all natural history courses embrace the principles and practice of logic, and that writers of manuals and text-books, while not neglecting correctness, conciseness and completeness, pay more heed to the other two commendable C's, Clearness and Consistency.

The paper was discussed by Drs. Baker, Dwight and Allen.

FIFTH.—“THE COMPARATIVE ANATOMY OF THE CEREBAL CIRCULATION, WITH AN EXHIBITION OF A SERIES OF ANOMALIES OF THE CIRCLE OF WILLIS.” DR. LEIDY.

Read by title in the absence of the author.

SIXTH.—“CONVOLUTIONS OF THE HEMISPHERES OF ELEPHAS INDICUS.” DR. HUNTINGTON.

Discussed by Drs. Wilder and Baker.

SEVENTH.—“CLASSIFICATION OF THE TISSUES OF THE ANIMAL BODY.” DR. BAKER.

Discussed by Drs. Heitzmann, Wilder, Dwight and Lamb.

Dr. Heitzmann said: There can be no doubt that even the most complicated organism is the outcome of purely epithelial structures, for the ovum of the female and the spermatozooids of the male are epithelial. The fully developed organism, being continuous throughout all tissues in its living matter, is an individual *in toto*, and not made up of millions of individual cells, as the cell theory has suggested; it is, therefore, comparable with the most elementary organism, such as is the amœba. The body of all higher developed animals is covered by a layer of epithelia, comparable with the thin layer of living matter, surrounding and enclosing the amœba. From this layer arise the hairs with their root-sheaths and sebaceous glands, the sudoriparous glands, the crystalline lens, the enamel organ, etc. All cavities traversing the organism that are in direct or indirect connection with the outer epithelial layer are true epithelial structures. Such are, first, the alimentary tract (the alimentary and mucous glands emptying themselves into it), in indirect connection with the respiratory tract; and, third,

the uro-genitary tract. Closed cavities, such as those between the cerebro-spinal membranes, the ventricles of the brain and the central canal of the spinal cord, the pleural cavities, the pericardial sac, the peritoneal cavity, all blood and lymph vessels, the cavities of the heart and all articulations are lined by a thin layer of living matter, the same as are the vacuoles visible as transient formations in a living and creeping *amœba*. This layer has been dubbed endothelial, though there is no morphological or chemical difference between epithelia and endothelia. Besides, at the fringed extremities of the Fallopian tubes, there is a direct connection of the epithelia of the mucosa with the endothelia of the peritoneum. A strict distinction between epi- and endothelia is, in my conviction and in accord with French histologists, not tenable.

The rest of the body of the *amœba* is continuous in its living matter, arranged mostly in a reticular shape. Here a localization or division of labor has taken place into three varieties of tissue, which we must adhere to for the sake of convenience. There are 1, The connective tissue, being of little vital significance, but important as the only carrier of blood and lymph vessels; 2, The muscle tissue, as the motor apparatus proper; and 3, The nerve tissue, as the apparatus for intelligence, for conveyance of motor and sensory impulses, as the superintendent of all functions of the organism. The central nerve organ, the brain and spinal cord, are unquestionably the products of a strictly epithelial layer, viz: the epiblast or ectoderm. A transformation of the epithelia of the epiblast into nerve tissue is always preceded by a change of the epithelia into indifferent or medullary tissue. To say, as Balfour did, that the nerve tissue is epithelial; or to say that the original epithelia of the mesoblast directly become "ganglion cells," as Herrick did, I would consider erroneous, since all tissue changes are preceded by a stage of indifference.

In conclusion I would draw attention to the fact that in transitory vacuoles of the creeping *amœba* we often meet with detached granules of living matter, which float in the fluid filling the vacuole. Since the vacuole of the *amœba* is comparable with blood vessels of a highly developed organism, the granules suspended therein I would compare with red and colorless blood corpuscles. Blood, however, is a fluid, not a tissue.

Dr. Dwight thought that no system could be satisfactory or more than a convenience. Not only normal development but experimental teratology show that the most diverse tissues can arise from apparently similar cells.

Dr. Lamb called attention, however, to the fact that the most usual classification of tumors depended on the fact that connective tissue tumors arise in connective tissues, and epithelial tumors in epithelial tissues, almost without exception.

EIGHTH.—“THE SIGNIFICANCE OF ANOMALIES.” DR. DWIGHT.

[Reprinted from “The American Naturalist,” February, 1895, p. 130.]

This subject, which, after consultation, has been chosen for our discussion this year, is one which for a long time has interested and puzzled me extremely. I look forward with great pleasure to the light which I hope will be thrown upon it by distinguished members of this Association. For my part I propose merely to state some of the difficulties which it seems to present and suggest one or two general conclusions which seem to me to be justified.

Probably no biological phenomena have been more confidently explained by heredity and atavism than rudimentary organs and anomalies. The former, of constant occurrence, though perhaps of transitory existence, have been happily compared by Darwin to letters in words which are no longer sounded, but which were pronounced at an earlier stage of the language.

Anomalies are the occasional appearance of structures normal in other animals. That these are found very commonly in man everyone knows. Whether they are found equally common in animals is a matter of uncertainty. Mr. Dobson believes that man as the type of a domesticated animal is particularly liable to them, and that in wild animals they are extremely uncommon. To this may be opposed the great frequency of anomalies in negroes. If I am not mistaken, other rebutting evidence is furnished by comparative anatomy. The same explanation has held for these; but, as their gradually increasing numbers have brought more accurate study, serious difficulties have arisen. It is clear that if an anomaly in man is to be called a reversion, either the species in which it is normal must have been in the direct line of ancestry, or there must have been a common progenitor. Evident as this is it has been grossly disregarded, not only by popular scientists, but by some from whom better might be expected. To point out the animal in which a certain anomaly is normal has been too often offered as an explanation. Critical study makes many difficulties, and the number of these are vastly increased when we come to account for the anomalies.

not only for certain anomalies, but for all. At the very least there must be no case clearly at variance with the explanation.

All anomalies have not the same significance. Certain ones represent structures widespread throughout mammals, some of them even in other classes of vertebrates. Three of these may be mentioned: the supra-condyloid process, the third trochanter, the para-mastoid process. Of the first there is usually no trace in man. The second is represented at most by a roughness of doubtful interpretation; in my opinion it is usually wholly absent. The third is wanting, or a mere point. The occurrence in man of a third trochanter is very common, that of the supra-condyloid process uncommon, and a really large para-mastoid process is a great rarity. None of them occur normally in the Simiidæ (the anthropoid apes). Of these structures the most general is the supra-condyloid foramen. In the primates it is practically universal among the Lemuroidæ, but among the Anthropoidæ it occurs only among some of the smaller monkeys—some of the Cebidæ.

The third trochanter also is almost universal among the Lemuroids as a rudiment, and in some species reaches a moderate development. There are traces of it in some of the smaller monkeys, and it is occasionally seen in the gibbons and the chimpanzee. I have tried to maintain that the true third trochanter in man, occurring very often on delicate bones, is different from the rough line for the insertion of the *glutæus maximus*.*

The para-mastoid process is, if I am not much mistaken, rudimentary or wanting throughout the primates.

When, therefore, we find a supra-condyloid process, which, with the completing ligament, represents the supra-condyloid foramen, to account for it atavistically the shortest leap is to the Cebidæ. In the case of the third trochanter we can hardly stop short of the lemuroidæ in spite of the probability that they and the anthropoidæ came from a common stem. For a really large para-mastoid process we must go beyond the primates altogether. There would be some comfort to be gained from the insectivora were we in the least justified in putting them among the ancestors of the primates, for several genera have a well-developed para-mastoid process, the supra-condyloid process is general, and the third trochanter is frequently represented, still it is neither general nor very prominent. For its greatest development we must turn to the odd-toed ungulata, and now descent is out of the question.

* Journal of Anat. and Phys., Vol. XXIV.

It may be opposed to this that we have no right to assume that a certain well developed anomalous process in man must necessarily be accounted for by inheritance from a form possessing an equal large one; that it is enough to show the existence of a clearly marked process in a common ancestor and to assume that its great development in the anomaly is an accident of no significance. I am quite willing to grant that this objection has weight. Still when we account by atavism for the supra-condyloid process we must admit that the gulf between the structure of man's body and that of one of the *Cebidæ* is so great that this explanation would hardly serve were it not absolutely necessary for a theory.

Another class of anomalies are those, which far from being general features, are found in certain highly specialized animals which can be included in no possible scheme of descent. An instance is the fossa prænasis, not to be confounded with the rounding of the border of the nares which is practically universal. It occurs in human skulls of a low order and presents a development which is seen in no animal. It is usually more or less distinctly marked in the seal tribe. I have seen it poorly marked in the gorilla. Here atavism is wholly at fault. The Pronator Quadratus muscle in man very rarely sends a prolongation downwards to one or more carpal bones on the radial side of the wrist. I am not aware that this is normal in any mammal. Whence then does it come? Testut would have it the homologue of a muscle which Humphry describes as pronator manus is *Cryptobranchus Japonicus* and of one described by Meckel in chelonians. It is curious that Macalister has found this arrangement in a tiger, and I have found it in both arms of a chimpanzee, which I believe is an unique observation. This shows a tendency in the carnivora and primates to similar variation which is not inherited.

Some of these anomalies present a likeness that is very probably accidental, possessing no significance whatever. Such is the peculiar union of the different pieces of the sternum by which the manubrium fuses with what should be the first piece of the meso sternum. Is the fact that this frequently occurs in the gibbons to be looked upon as anything but a coincidence? Does the occasional perforation of the thyroid cartilage by the superior laryngeal nerve in man derive any significance from the fact that this is so?

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than to some accident in the individual? Has the fact that the abnormal arrangement is normal in some animal any significance? These are questions which admit of no certain answer.

The second class of anomalies are those of most difficult explanation. They naturally suggest an analogy with the cases of the occurrence of similar structures in widely separated animals, such as a bill of a duck and of the *Ornithorhynchus*, the paddle of the cetacean and of the *ichthyosaurus*. The obvious retort is that these resemblances are superficial; but they are none the less true. Indeed, similar arrangements for a similar purpose are found which can in no way be called superficial. A very good example is furnished by Mr. Dobson.*

The Pyrenean water mole (*Myogale*) of the *Insectivora*, which has very elongated digits, has an enormously developed fibular flexor and a rudimentary tibial flexor. On the true moles the tibial flexor is larger, but the arrangement is the same. Now the *Bathyergus maritimus* of South America which has the habits of moles, but is really a rodent, has a precisely similar disposition of the parts. "Here the larger fibular flexor, as in *Myogale*, has forced the tibial flexor inwards, so that the latter is attached to the head of the tibia internal to the attachment of the popliteus; and its tendon being separated in the foot from that of the fibular flexor, is attached precisely as in the true insectivorous moles, to the tibial margin of the basal phalanx of the hallux, developing, as it crosses the ento-cuneiform articulation, a broad sesamoid ossicle." Mr. Dobson then asks: "How happens it that in certain widely separated species, in no way connected by descent from a common ancestor having similar peculiarities, separation of this tendon from that of the fibular flexor and attachment to a different part of the foot has occurred in a perfectly similar manner?" He finds this very difficult to answer, and can only suggest that the arrangement in question being the best, it has been reached independently in both species by natural selection.

Those of us who look upon natural selection pure and simple as quite inadequate to what is already required of it, will not be disposed to call upon it to do double duty. Those who, like myself, believe in design and in a limited evolution founded on law, while they may explain by teleology such instances as the last mentioned, can by no means apply that doctrine to anomalies.

The mechanical theory that the action of certain muscles

* On the Comparative Variability of Bones and muscles, etc. *Journal of Anat. and Phys.*, Vol. XIX, p. 20.

should account for certain processes, such as the third trochanter, is not admissible. I have shown that this anomaly occurs in savage races in which presumably all live pretty much the same life, and that further it occurs at too early an age to be caused by any strain in the individual.* Even were this not so there are many anomalies which obviously can have no connection with mechanics.

It is easier to destroy than to build. I can offer no substitute for the theories I reject which would itself stand criticism. I will merely offer the following as justifiable conclusions.

First, similarity of structure, either in the ordinary animal or in the one showing variations, is not necessarily a proof of descent. Second, those very irregularities, which we call abnormal, point to a law in accordance with which very diverse animals have a tendency to develop according to a common plan. This, be it noted, in no way denies the possible influence of surroundings.

NINTH.—“SOME MUSCULAR VARIATIONS OF THE SHOULDER GIRDLE AND UPPER EXTREMITY, WITH ESPECIAL REFERENCE TO REVERSIONS IN THIS REGION.” DR. HUNTINGTON.

TENTH.—“SOME ANOMALIES OF THE BRAIN.” DR. WILDER.

Dr. Wilder showed three remarkable specimens from the collection of Cornell University:

1. An adult human brain with a complete interruption of the central fissure. The total number of such cases does not exceed 20.†

2. A sheep's brain lacking the callosum or great cerebral commissure. Several human brains with this defect have been described, but the only other cases with animals are three cats, all in the Cornell Museum.‡

3. A human fetus, estimated at three months, where the left olfactory bulb, commonly rudimentary, is half as long as the cerebrum, as in most of the lower animals, and contains a considerable cavity. It has long been a belief of Prof. Wilder that the olfactory apparatus is primary and of great morphologic importance;§ that the recognition of food by the smell was once

* *Loc. cit.*

preliminary description is given in the “Journal of Nervous and Mental Medicine,” December, 1894.

† *American Journal of Neurology and Psychiatry*, August, 1888, and “*Reflexes of the Medical Sciences*,” VIII, 192.

‡ *Naturalist*, June, 1887, 546; “*Reference Handbook to the Medical Sciences*,” IX, 114; Note IX, 101.

more essential than reflection upon its qualities. The specimen in question, believed to be unique, suggests the possibility of reversion toward a far-off ancestral type.

ELEVENTH.—“THE CORRELATION BETWEEN SPECIFIC DIVERSITY AND INDIVIDUAL VARIABILITY, AS ILLUSTRATED BY THE EYE MUSCLE NERVES OF THE AMPHIBIA.” PROF. C. JUDSON HERICK.

The distinction between such anomalies as must be considered in teratology and that which may be called normal variability, and which is now absorbing so much attention in the biological world, is not an easy one to draw, nor, indeed, is it needful that it be sharply drawn, for the laws found to apply to the regular occurrences of the one will probably hold true *mutatis mutandis* in the more exaggerated cases of the other.

It is a familiar fact, that all of the orbital nerves show the greatest diversity among the various species of the amphibia as to their mode of origin, peripheral courses and terminal relations. The fourth nerve, for instance, is fused with the fifth in Salamandra and Pipa. In tadpoles Dr. Strong describes a small sensory intra-cranial twig. In the frog it terminates in the m. rectus superior. According to Wiedersheim, who also describes it as usually effecting an anastomosis with r. ophthalmicus trigemini, rarely distinct. It is exceedingly variable, the anastomosis, when present, presenting from one to five connecting filaments.

Now, in amblystoma the present writer has found the fourth nerve effecting the typical connection with the superior oblique muscle, and anastomosing with several small and distinct branches of the r. ophthalmicus trigemini. The details of this anastomosis are also extremely variable, as in the frog.

The other eye muscle nerves are quite as irregular in their distribution in the different species of amphibia, and a statistical study of their individual variations would probably prove suggestive.

This great diversity in the distribution of the eye muscle nerves among the various species of amphibia would seem to indicate that this group has passed through a period of great instability phylogenetically considered. There has therefore been less opportunity for cumulative heredity to introduce its conservative factor here than in those organs which, like the brain, have developed in a more continuous and unbroken manner. This weakening of the hereditary forces may be responsible for the

individual variability found in these nerves. Such variation is to be expected in all organs now suffering any considerable alteration in the phylogenetic development, whether of retardation or acceleration, as illustrated by the jaws of man and, as has been more recently shown, by the appendix vermiformis.

The discussion on papers 8 to 11 was opened by Dr. Baker, and continued by Dr. Shepherd, who illustrated his remarks with specimens; by Dr. Wilder; by Dr. Lamb, who also showed a specimen; by Dr. Huntington, and concluded by Dr. Dwight.

Dr. Shepherd stated that he had for many years taken a great interest in the subject of anomalies, and had come to the conclusion that there were many kinds of anomalies, some having *no significance* and others *having significance*. His own division was as follows:

(1) Reversion to former types or atavism, as where a muscle suddenly appears, no rudiment existing normally in the individual, *e. g.* The occipito-scapular, chondro-scapular and flexor-indicus muscles, and many others.

(2) Increase and development of parts which are rudimentary or have retro-graded, *e. g.* Epitrochleo-anconeus, coraco-brachialis inferior. Paramastoid process; third trochanter; cervical and lumbar ribs, etc.

(3) Reduplication or repetition of parts owing to excess of generative material, *e. g.*, some cases of polydactylism and double extremities, etc.

(4) Anomalies of vessels, chiefly from accidental causes, as the occlusion of a main trunk and the carrying on of the circulation by anastomotic branches.

(5) Persistence of foetal conditions, *e. g.*, double superior vena cava; imperforate anus and rectum; hare-lip; Meckels' diverticulum, etc.

Another class might be made of those cases where injury in early foetal conditions leads to monstrosity.

In the first two classes only have the anomalies any significance. In these there is doubtless reversion to a previous condition, for many of these anomalies are normal in animals lower in the scale, the chondro-scapular muscle occurring in the Norway rat, etc., the coraco-brachialis inferior in climbing and swimming animals (graminivorous and carnivorous). The paramastoid is seen in the goat, sheep, lion, etc.; the third trochanter in many animals as horses, rhinoceros, etc.; the supracondyloid

process in nearly all the carnivora, plantigrades, monkeys, lemurs and sloths.

Of course, the anomalies due to arrest of development indicate the persistence of transient conditions, which are always permanent in animals lower in the scale.

Dr. Shepherd agreed with Professor Dwight regarding the third trochanter, for he had seen it markedly developed in the femur of an idiot who had never walked, and whose bones were much atrophied, the femur being no thicker than one's finger, and the muscles also of insignificant size. This third trochanter was interesting, because in certain races, as the Swedes and Laplanders, it occurred very frequently. He did not think that anomalies occurred more frequently in the domestic than the wild animals, and Bateson, in his recent work on "Variations," fully substantiated this view.

The able paper of Professor Huntington greatly interested him, and the accurate observations made by him will prove most useful in elucidating many obscure points about the biceps.

He did not agree with Dr. Huntington on all points, and regarded the gleno-humeral ligament as not connected with the biceps, but with the subclavius, of which it is the divorced tendon and the homologue of the ligamentum teres in the hip. In carinate birds the gleno-humeral ligament is the insertion of the levator humeri. The coraco-humeral ligament is regarded as the divorced tendon of the pectoralis minor muscle. This muscle occasionally fails to be inserted into the coracoid, and goes on to the great tuberosity of the humerus. This condition is normal in many monkeys, according to Bland Sutton and others. He understood Dr. Huntington to say that the biceps became divided up and acquired more heads by reason of the more complicated and free movements of pronation and supination in man. Now, in some animals a three-headed biceps is normal (seal, bat, etc.), and in these the fore-limb is permanently pronated.

Dr. Shepherd next exhibited (1) a skull with a paramastoid process on each side, well developed and articulating with the transverse processes of the atlas.

(2) An example of the neural arch of the 5th lumbar vertebra, divided by a cleft passing obliquely between the superior and inferior articular processes of each side. This confirmed the statement of Rambaud and Renault that there are always two nuclei in each half of the neural arch. This anomaly was not uncommon.

(3) Two casts, one of foot and one of hand of child, showing polydactylism. The foot showed the post minimus and a large præpollex, the hand a large præpollex. These casts were taken

from two brothers. In one there were six toes on each foot, the supernumerary being a post minimus; and a præpollex on right hand, whilst in left hand was a post minimus and a very broad thumb, which had a bifurcating last phalanx. In the other child there was a large præpollex on each foot and a small post minimus, whilst each hand carried a supernumerary finger, a post minimus.

The mother said that the father of these children was similarly deformed, being furnished with six fingers and six toes.

Dr. Lamb presented a specimen from a six weeks old infant, showing a congenital valve-like opening between the œsophagus and trachea, corresponding to the 6th and 7th rings. The child died from pneumonia caused by regurgitation of food from the œsophagus into the trachea followed by its inspiration into the lungs. Dr. Lamb stated that this anomaly was very rare; while at first sight it did not appear to be a case of reversion one might yet imagine that, as in the chick and many other animals, the œsophagus after becoming patulous, solidified and then reopened; perhaps in the reopening the process went too far and caused this anomaly.

A DECEREBRIZED FROG.

At the close of the session Prof. Wilder showed a frog from which, under ether, the entire cerebrum was removed on December 7th, three weeks before. It looked natural. The scar on the head was hardly visible. It could swim and jump and even balance on a cylinder while it was slowly turned, and swallowed food that was placed far back in the throat. But when undisturbed it sat without motion, and presumably had no consciousness. That such a frog, while in possession of all his senses (excepting smell, the olfactory lobes being removed with the cerebrum) has no real "sense" may be seen from the behavior of a similar specimen shown the American Neurological Association in 1886.* A minnow was put into the mouth. The head reached the throat and aroused the swallowing reflexes; but the tail protruded from the lips and caused the frog to put up his hands to push it out. The normal frog would have decided whether the fish should go up or down. The decerebrized animal was a mere reflex machine, and could make no choice between incompatible operations.

*marks upon a living frog which was decerebrized more than seven months
 "American Neurological Association Trans.," 1886. "Journal Nerve and
 Disease," XIII, p. 30. Abstracts in "New York Medical Record," July 31,
 "Science," August 6, 1886, and "Medical News," August 7, 1886. See, also,
 "ence," May, 1895.

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Herrick, Clarence Luther, M. S. Granville, Ohio.

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- Moody, Robert Orton, B. S., M. D.** Fair Haven Heights, New Haven, Conn.
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Professor of Anatomy and Lecturer on Operative Surgery, McGill University,
Montreal.

Shufeldt, Robert Wilson, M. D., C. M. Z. S. Assistant Surgeon,
U. S. A. (Retired).

Smithsonian Institution, Washington, D. C.

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Professor of Anatomy, Medical Department, Columbian University, Wash-
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Professor of Anatomy and Clinical Surgery, Tulane University, New Orleans.

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Principal of State Normal and Training School, Potsdam.

Summers, Henry E., B. S. Champaign, Ill., or 71 North Water
st., Rochester, N. Y.

Illinois State Laboratory of Natural History.

Tupper, Paul Yoer, M. D. St. Louis, Mo.

Professor of Anatomy, St. Louis Medical College.

Turner, Wm., M. B., F. R. C. S. Ed., M. R. C. S. Eng., D. Sc., LL. D.,
D. C. L. 6 Eton Terrace, Edinburgh, Scotland.

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Honorary.

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Professor of Anatomy, New York College of Dentistry, N. Y. City.
- West, George William, M. D. 1102 14th st., nw., Washington,
D. C.
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- Wilder, Burt G., M. D., B. S. Ithaca, N. Y.
Professor of Physiology, Vertebrate Zoölogy and Neurology, Cornell University, and Curator of the Vertebrate Division of the Museum.
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Professor of Anatomy, Medical College, University Southern California.
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Professor of Physiological Botany, University of Pennsylvania, Philadelphia.
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D. C.
Professor of Medical Jurisprudence, Medical Department, Georgetown University, Washington.
- Wortman, Jacob L., M. D. New York City.
Assistant in Palæontology, American Museum of Natural History, Central Park, New York City.

GEOGRAPHICAL DISTRIBUTION OF MEMBERS.

New York,	21	Texas,	2
Pennsylvania, . . .	18	New Jersey, . . .	1
District of Columbia, .	15	Maryland,	1
Massachusetts, . . .	9	West Virginia, . . .	1
Connecticut,	5	Iowa,	1
Ohio,	4	Michigan,	1
Missouri,	4	Wisconsin,	1
Illinois,	3	Minnesota,	1
Canada,	3	Colorado,	1
Maine,	3	Arizona,	1
United States Army, . .	2	California,	1
Virginia,	2	Ireland,	1
Louisiana,	2	England,	1
		Scotland,	1

Total: 106 active, 3 honorary.

PROCEEDINGS
OF THE
EIGHTH ANNUAL SESSION
OF THE
Association
of
American Anatomists,

Held in Philadelphia, December 27 and 28, 1895.

TO WHICH IS APPENDED A
LIST OF MEMBERS.



WASHINGTON, D. C.
BARESPORD, PRINTER, 617 E STREET.
1896.

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PROCEEDINGS OF THE EIGHTH ANNUAL SESSION.

The eighth annual session of the Association was held in the College Hall of the University of Pennsylvania, Philadelphia, Pa., December 27 and 28, 1895, in conjunction with the American Society of Naturalists, the American Physiological Society, the American Morphological Society, the American Psychological Association and the Geological Society of America. The American Folk-Lore Society met at the same time.

Dr. Dwight, President of the Association, presided at the several meetings.

FRIDAY, DECEMBER 27TH. MORNING.

The meeting was opened with an address by the President. (See page 12.)

Dr. Lamb, Secretary and Treasurer, submitted his report for the previous year. The following extracts are made:—

The Association has lost the following members by resignation: Henry Earl Clark, Professor of Natural History, Clinton Liberal Institute, Fort Plain, N. Y., and Dr. Maurice Howe Richardson, Asst. Professor of Anatomy, Harvard Medical School.

The financial exhibit is as follows:

Receipts.

Balance on hand Dec. 29, 1894,	\$163.90
Received from dues,	150.15
Total,	<hr/> \$314.05

Expenses.

For Printing and Stationery,	\$144.60
" Postage,	31.95
" Typewriting and Copying,	7.35
" Sundries,	2.08
	<hr/> \$185.98

Dec. 26, 1895, remaining on hand, \$128.07

The arrears for dues are as follows: 27 members owe for *one* year; 10 for *two* years; and 6 for *three* years; total \$130.00 in arrears. Under Section 9 of the Constitution these six members' names will be dropped at this session, unless their dues are paid. They may, however, be restored to membership on payment of arrears, at the discretion of the Executive Committee.

The President appointed Drs. Baker and Gerrish to audit the Treasurer's accounts.

The Committee on Anatomical Nomenclature made the following report:

The Committee report general progress in the consideration of the complex subject entrusted to them, and express the opinion that substantial improvement will result from the work of the Committee of the *Anatomischer Gesellschaft*.

Your Committee recommend to anatomists that, other things being equal, terms consisting of a single word each be employed rather than terms of two or more words.

(Signed.)

HARRISON ALLEN, *Chairman*,
 THOMAS DWIGHT,
 FRANK BAKER,
 FREDERIC H. GERRISH,
 BURT G. WILDER, *Secretary*.

The report was discussed by Dr. Wilder and adopted, including its recommendation.

The Committee on Circular in regard to the Anatomical Peculiarities of the Negro, Dr. Lamb, Chairman, reported progress. Report accepted.

Dr. Allen, of the Smithsonian Committee on the Table at Naples, reported that he had no particular information to communicate. By request of Prof. C. W. Stiles, of the said Committee, communicated through Dr. Lamb, that another member of the Association be added to the Committee, the President appointed Dr. Huntington.

The Committee on the Collection and Preservation of Anatomical Material, Dr. Mears, Chairman, made report.

The report was discussed by Drs. Wilder, Gerrish, Huntington, Dwight, Bevan, Holmes and Mears. Dr. Holmes offered the following additional recommendation, which was adopted:

"That Professors of Anatomy be requested to inform their students concerning the laws upon the subject of anatomical material, and request these students to use their influence with the authorities in their respective places of residence to increase the quantity of anatomical material by making available much that is now withheld, either from neglect or indifference."

The report as amended was then adopted, and the Secretary was instructed to send a copy of the report as amended and a copy of the Pennsylvania anatomical law, and also a copy of the President's address, to the Professors and Demonstrators of Anatomy in the United States and Canada.

The Executive Committee reported favorably upon the following applications for membership, viz: Drs. Christian, Dawbarn, Frost, Lewis, Schaper, Stewart, Stroud and Woolsey. The Committee also recommended for honorary membership, Professors Flower and Humphry of England. All the gentlemen were elected. (See list of members.)

The following letter was read:

PHILADELPHIA, *December 27, 1895.*

To the ASSOCIATION OF AMERICAN ANATOMISTS :

Gentlemen: A number of medical men in this city, former students of Professor Joseph Leidy, have formed a Committee for the purpose of raising a fund of \$30,000, to endow a Fellowship of Anatomy under his distinguished name in the Wistar Institute. A large part of the desired sum has already been raised.

The reputation of Dr. Joseph Leidy was of such an international character, and his scientific work so thoroughly representative, that it has seemed eminently appropriate to appeal to your learned body to add your influence in raising the fund and to contribute whatever you may feel disposed as a matter of sentiment to so deserving a memorial.

(Signed.)

MR. C. C. HARRISON,
DR. J. M. DA COSTA,
DR. S. WEIR MITCHELL,
DR. GEORGE A. PIERSOL,
GEN. ISAAC J. WISTAR,

DR. WM. C. POSEY, *Chairman*,
J. HOWE ADAMS, *Secy. and Treas.*,
JOSEPH LEIDY, JR.,
JOSEPH P. TUNIS,
C. H. FRAZIER,
Committee of the Alumni.

Also a letter from the American Philosophical Society, through its Secretary, Mr. Geo. H. Horne, inviting the members of the Association to visit the rooms of the Society and avail themselves of such privileges as it had to extend.

Dr. Huntington made remarks upon "Myology of the extremities of Lemur Bruneus." Illustrated by drawings and casts of muscles. The subject was discussed by Drs. Wilder and Dwight.

The President appointed Dr. Allen, Professor Cope and Mr. Lucas, a Committee on Nomination of Officers for the ensuing term.

The Association then took a recess to partake of lunch kindly furnished by the University authorities.

AFTERNOON MEETING.

The Association reassembled at 2.30 P. M. Dr. Hewson read a paper on "Absence of Fibrous Pericardium of left side." Illustrated by specimen. Discussed by Drs. Wilder, Dwight and Bevan.

Dr. Baker read a paper on the "History of the Ciliary Muscle." Discussed by Dr. Wilder.

A paper by Dr. Keiller on "The Descriptive Anatomy of the Human Heart," in the absence of the author, was read by Dr. Gerrish. Discussed by Drs. Wilder, Dwight, Fish, Allen and Gerrish.

Dr. Baker read a paper on the "Nomenclature of Nerve Cells." Discussed by Drs. Wilder, Fish, Dwight and Minot.

Dr. Minot made remarks on "Practical Histology for Large Classes." Discussed by Drs. Bevan, Baker, Dwight, Wilder and Moody.

The Executive Committee reported favorably upon the applications for membership of Drs. Lindsay and Tunis, and they were elected. (See list of members.) The Association then adjourned until next morning.

In the evening, a subscription dinner was given by the members of the affiliated societies at the Hotel Lafayette.

SATURDAY, DECEMBER 28TH.

The Association assembled at 10 A. M.

The Committee on nomination of officers for the ensuing term reported as follows :

For President,	. . . . .	Dr. Baker.
For Vice President,	. . . . .	Dr. Wilder.
For Second Vice President,	. . . . .	Dr. Shepherd.
For Secretary and Treasurer,	. . . . .	Dr. Lamb.
For Delegate, &c.,	. . . . .	Dr. Hewson.
For Delegate, alternate,	. . . . .	Dr. Shute.
For member of Executive Committee,	. . . . .	Dr. Bevan.

Dr. Baker nominated Dr. Wilder for President ; Dr. Wilder declined ; the ballot showed—Baker, 7 votes, Wilder 1. There being no other nominations for the other offices, the nominees were unanimously elected.

Dr. Wilder read a paper on "The Cerebral Fissures of Two Philosophers." Illustrated by specimens and photographs. Discussed by Drs. Dwight, Baker, Huntington, Hodge and Allen.

Dr. Wilder next read a paper on "The Human Paroccipital Fissure: Should it be recognized and so designated?" Illustrated by specimens and photographs. There was no discussion.

Dr. Allen made remarks on "Some Novel Methods of Description of the Human Skull." Illustrated by specimens. There was no discussion.

The Association then took a recess to attend a reception and lunch tendered by Mr. W. B. Saunders, at the rooms of the Art Club.

AFTERNOON MEETING.

The Association reassembled at 3 o'clock.

The Executive Committee reported favorably on the application of Dr. Cotton for membership, and he was elected. (See list of members.)

The Auditing Committee reported that the Treasurer's accounts were correct.

Dr. Brockway read a paper on "Fossa Capitis Femoris ; with Observations on the Trochanteric Fossa." Illustrated by specimens. Dr. Lamb read a note on the "Appearance of a Unilateral Tuberosity in place of the Trochanteric Fossa." Illustrated by specimen. The two papers were discussed by Drs. Wilder and Dwight.

Dr. Lamb reported "A case of Polyorchis." Illustrated by a sketch.

Dr. Fish read a paper on "The Cerebrum of *Phoca Vitulina*." Illustrated by specimen. Discussed by Drs. Wilder and Dwight.

The Secretary was instructed to send a letter of thanks to the diversity authorities, to Mr. W. B. Saunders and to the Ameri-

can Philosophical Society for courtesies tendered to the Association.

The Association then adjourned *sine die*.

The following members were present at sometime during the session: Allen, Baker, Bevan, Birkett, Brockway, Brooks, Cotton, Dwight, Fish, Forbes, Gerrish, Greenman, Hamann, Hewson, Hodge, Holmes, Huntington, Lamb, Lindsay, Mears, Minot, R. O. Moody, Tunis and Wilder.—24.

The following members of the Association were in attendance on the affiliated societies; Cope, Gill, Jayne, Lucas, Matthews, Osborn and Scott.—7.

On the evening of the 26th, Prof. Scott gave a lecture at the Academy of Natural Sciences on the "History of the Lacustrine Formations of North America and their Mammalian Fossils;" after which a reception was given by Dr. Jayne at his residence.

An abstract of the proceedings was furnished by the Secretary to "Science" (see N. S., Vol. III, No. 55, Jan'y 17, 1896,) and to the "American Naturalist" (Feb., 1896, p. 165). Abstracts of the papers read and discussed were furnished by the stenographer, Mr. H. B. Mills, Philadelphia, to several medical journals, including Jour. Amer. Med. Asso., 1896, XXVI, page 80.

CONSTITUTION.

SECTION 1. The name of the society shall be the "Association of American Anatomists."

SEC. 2. The Association shall have for its object the advancement of the anatomical sciences.

SEC. 3. The officers of the Association shall consist of a President, two Vice Presidents and a Secretary, who shall also act as Treasurer.

SEC. 4. The officers shall be elected by ballot every two years.

SEC. 5. The management of the affairs of the Association shall be delegated to an Executive Committee, consisting of its President, Secretary and three other members.

SEC. 6. One member of the Executive Committee, shall be elected annually.

SEC. 7. The Association shall meet annually, the time and place to be determined by the Executive Committee.

SEC. 8. Candidates shall be proposed in writing to the Executive Committee by a member. Each proposal shall be made at or before the first session of any regular meeting of the Association. The proposal shall state the official position or occupation of the candidate and the character of his investigations. The election shall take place by ballot in open meeting, a two thirds vote being necessary. Honorary members may be elected from those, not Americans, who have distinguished themselves in anatomical research.

SEC. 9. The annual dues shall be two dollars. A member in arrears for dues for two years shall be dropped by the Secretary at the next succeeding meeting of the Association, but may be restored on payment of arrears, at the discretion of the Executive Committee.

SEC. 10. The rulings of the Chairman shall be in accordance with "Robert's Rules of Order."

SEC. 11. Five members shall constitute a quorum for the transaction of business.

OFFICERS FOR THE YEAR 1895-'96.

DR. FRANK BAKER, of Washington, D. C., - - - - President.
 DR. B. G. WILDER, of Ithaca, N. Y., - - - - First Vice President.
 DR. F. J. SHEPHERD, of Montreal, Canada, - - - - Second Vice President.
 DR. D. S. LAMB, of Washington, D. C., - - - - Secretary and Treasurer.

**DELEGATE TO EXECUTIVE COMMITTEE OF CONGRESS OF AMERICAN
 PHYSICIANS AND SURGEONS.**

DR. ADDINELL HEWSON, of Philadelphia, Pa.

ALTERNATE.

DR. D. K. SHUTE, of Washington, D. C.

EXECUTIVE COMMITTEE.

DR. THEODORE N. GILL, of Washington, D. C.
 DR. GEO. S. HUNTINGTON, of New York City.
 DR. ARTHUR D. BEVAN, of Chicago, Ill.
and the
 PRESIDENT and SECRETARY, *ex officio*.

COMMITTEE ON ANATOMICAL NOMENCLATURE.

DR. HARRISON ALLEN, of Philadelphia, Pa.
 DR. FRANK BAKER, of Washington, D. C.
 DR. THOMAS DWIGHT, of Boston, Mass.
 DR. F. H. GERRISH, of Portland, Me.
 DR. BURT G. WILDER, of Ithaca, N. Y., *Secretary*.

**COMMITTEE ON CIRCULAR IN REGARD TO ANATOMICAL PECULIARITIES
 OF THE NEGRO.**

DR. D. S. LAMB, of Washington, D. C.
 DR. FRANK BAKER, of Washington, D. C.
 DR. D. K. SHUTE, of Washington, D. C.

MEMBERS OF SMITHSONIAN COMMITTEE ON THE TABLE AT NAPLES.

DR. HARRISON ALLEN, of Philadelphia, Pa.
 DR. GEO. S. HUNTINGTON, of New York City.

"OUR CONTRIBUTION TO CIVILIZATION AND TO SCIENCE."

ADDRESS OF PROF. THOMAS DWIGHT, HARVARD MEDICAL SCHOOL,
President of the Association.

[Reprinted from *Science*, Vol. III, 1896, No. 55.]

It had not been my intention to inflict upon the Association a Presidential address; but at a late moment, impressed with the gravity of the matters that are to come before us, far transcending, as one of them does, the importance of purely scientific discussion, I felt it a duty I owe to the position I have the honor to hold, to introduce them to the Association with the best suggestions concerning them I can offer. It is not too much to call them our contribution to civilization and to science. Easily first in importance is the report of the committee on procuring and using anatomical material. Though both branches of the question are of interest to anatomists, the first rises beyond the sphere of the specialist. It is a social question of the first importance. I shall not anticipate the report of the committee of which I am a member. I wish merely to lay down briefly certain principles which, I conceive, should guide us. We know only too well that dissection is an abomination to the popular mind. The aversion to it is well nigh universal, confined to no class of society, nor to any creed. This horror seems to be founded chiefly on two points, one the deprivation of sepulchre, the other the idea that the remains are submitted to wanton insult. The idea that respect is due to the dead body is so deeply rooted in the human mind as to be almost instinctive. I am far from calling these feelings superstitious. We know, indeed, that no violence can harm the dead, but, though reason is convinced, the heart is not satisfied. We anatomists, no less than others, shudder at the thought of the desecration of the remains of those who have been near and dear to us. The madness by the feeling that graves are not safe is a well known fact. It is a disgrace to our civilization that in some parts of the Union body-snatching is still practiced, and that in others exists an illicit trade in human bodies. Should any

of my colleagues think me indiscreet in alluding to these matters, I must remind them that I am saying nothing which has not been made notorious through the public press.

It is idle to hope, while human nature remains what it is, that aversion to dissection will ever disappear. Our wisest course is to recognize it, and to soften it by removing all just cause of complaint. It should be made clear to the public that dissection can and should be followed by decent burial. I, myself, would go so far as to have the bodies of Protestants and Catholics buried in their respective cemeteries, when the creed of the deceased is known. It also should be understood that no wanton insult is permitted in reputable schools.

From careful observation I am convinced that the policy which will lead to the most satisfactory results is one of complete openness, that above all, we should avoid a timidity which shirks discussion of this topic. When we shall show so clearly as to carry conviction, that we have nothing to conceal, a great step will have been taken. I like to boast that the anatomical department of the Harvard Medical School is ready to give an account of every body it receives. If there be aught in the management of dissecting rooms that calls for criticism I would not have reform forced upon us from without. Let us be the first to anticipate every reasonable demand.

It seems to me that this is making every possible concession to the sentimental side of the question; but another complaint is often made in all honesty, by well-meaning persons, who object that the bodies of the poor should be treated otherwise than those of the rich. I reply that no one would reprobate more strongly than I any law that would allow the taking of the bodies of the poor from their near relatives; but we must distinguish between the respect due to the feelings of the living and any admission that dissection is in itself an injury to the dead. The former is humanity; the latter is superstition, and to my mind, a very contemptible one.

I have alluded to the scandal of body-snatching, but an equally great scandal is its cause, the want in many places, of an anatomy act, or the existence of one which the framers and all others know to be inadequate. This state of affairs is in more respects than one an injury to the community. Like a prohibitory law meant to be boasted of on the platform and in the pulpit, but not meant to be enforced, it destroys respect for law. It is the bounden duty of authorities of States, without adequate provision for dissection, to see that it is not practiced. After all, such communities deserve to be treated by surgeons ignorant of anatomy.

A radical defect in the laws of many States, otherwise well drawn, is that the delivery to medical schools of unclaimed bodies is optional with superintendents, boards of trustees and municipal authorities. The result of this is that those in authority very naturally hesitate to do anything for the advancement of science, which not only can be of no possible advantage to themselves, but may involve them in serious difficulties. The cry of outrage on the poor is a sure card in the hand of the political demagogue, especially when it is raised against some honored institution. It may also be used as a means of annoyance against political opponents. It is far easier, therefore, for those in office to remain quiet and leave science to suffer. A mandatory law would free them from all responsibility. "Thyself shalt see the act," would be a sufficient answer to all complaints.

Details of law may and must differ with the locality, but a good anatomy act should have the following characteristics: First, it should be just, safeguarding the rights of the poor, and securing decency: next, that it should be mandatory: finally, it should be easy of execution. It is our duty in our several States to do our utmost for the passage of a law that shall advance science, protect the grave and do credit to the community. We have not the excuse of older times, that the question is a new one. In view of our own shortcomings it behooves us to judge them lightly. For my part, I have far more respect for those who opposed dissection on the ground, however mistaken, that it might be displeasing to God, than for those who make it illegal by pandering to the prejudices of the ignorant. Dr. Johnson's advice, "free your mind from cant," is here singularly *à propos*. We cannot boast of our civilization till this is remedied.

Another subject which comes before us for discussion is the important question of anatomical nomenclature. German anatomists have recently adopted a report prepared by some of their number working in company with representatives of other European countries. It is for us to consider whether this one can be looked upon as accepted and whether it is acceptable; whether we can join hands with our foreign colleagues, or whether we can devise an American nomenclature which shall be so much better that we can disregard the inconvenience of a distinct standard. We have had for years a committee on Anatomical Nomenclature, with Professor Wilder for secretary, who has given so large a part of his busy life to this matter. We may expect an important contribution to the matter in the report of this committee.

We are to hear also from the committee appointed to consider

the anatomical peculiarities of the negro. I am not informed what success has been reached in the difficult task of collecting statistics. It is a work of such anthropological importance that it would be doubly to be regretted should it come to naught. As has already been said at our meetings, it is most proper that this Society should collect all possible information as to the anatomy not only of the negro, but of such savage races as still survive in North America, and of the extinct ones, whose bones can still be procured in large numbers.

Thus, gentlemen, you see that this meeting, besides the attractive list of papers, has before it matters of no ordinary interest and importance. I will no longer detain you from your work, firmly persuaded that the action of this Association will be in the interest of civilization and science.

REPORT OF THE COMMITTEE ON THE COLLECTION AND PRESERVATION OF ANATOMICAL MATERIAL.

[Reprinted from *Science*, Vol. III, No. 55, January 17, 1896.]

TO THE ASSOCIATION OF AMERICAN ANATOMISTS:

The committee appointed at the meeting of the Association to obtain information with regard to the collection and preservation of anatomical material, and report what in its opinion are the best means of accomplishing these objects, begs respectfully to submit the following report:

In order to make the work of the committee as comprehensive as possible and to obtain information which would be of service in arriving at definite conclusions as to the best methods of accomplishing the purposes in the resolution, the committee deemed it desirable to send to the teachers of anatomy, not only in this country, but abroad, a circular letter, with the following questions appended, and respectfully requested answers to be made thereto as fully as possible:

1. Is anatomical material obtained in accordance with legal enactment, wholly or in part?

2. Is there an Anatomical Law in your State or country? If so, please send a copy to the chairman of the committee. Please state whether the law is satisfactory in its provisions, whether it is readily obeyed by those upon whom duties are imposed by it, and mention any improvements you would suggest as to its requirements.

3. Is the material received in good condition?
4. What disposal is ultimately made of the remains?
5. Please state what means are employed to preserve anatomical material for the purposes of dissection or operative surgery. If injections of preservative fluids are used, state their composition and the methods of use, at what point injections are made, whether at the heart or in the large arteries, and their effect in accomplishing the preservation, with any changes in the color or character of the tissues. What length of time can material be used in dissection employed by you? If preservation by means of cold storage is employed, please state the cost of the machinery which it was necessary to construct for this purpose, and what means are taken to prevent decomposition after the subject is placed upon the table for dissection.
6. Please state the cost by the method employed by you, for the reception, the injection and preservation of each subject.
7. Do you obtain an adequate supply of material for the purposes of anatomical instruction? How many students are assigned to each subject, and what is the method of allotment?
8. Please give any further information which you may deem of importance.

This letter was sent to the professors of anatomy in 148 colleges in the United States, 25 in foreign countries, and 25 copies were sent to the medical journals in this country and abroad. Forty-two replies have been received by the committee containing more or less specific answer to the questions propounded in the circular. An analysis of the replies received presents the following results:

1. Anatomical material is received wholly under the provisions of the law in thirty States and countries, in part by law, in seven; and without law, in five.
2. In reply to the second question proposed, fifteen copies of the laws which are in force, have been sent to the chairman of the committee, thirteen of them being the laws of States of this country and two of foreign countries. With regard to the execution of the law, information was given to the effect that the provisions of the law were satisfactorily complied with in ten, fairly so in ten, not satisfactory in twelve, and no replies were given in ten. In eight the provisions of the law were stated to be obligatory, and in six the provisions were optional. In considering the subject of the report so far as it relates to the collection of anatomical material by law, the committee has confined itself to the examination of and report on the anatomical laws of the States of this country.
3. The report as to the condition in which anatomical material

was received was that in twenty instances it was good ; in twenty-one, fair ; and in one, bad.

4. As to the disposition of the remains, in twenty-seven institutions they were reported buried ; in ten, cremated ; and in four, thrown away.

5. The answers received to the question with regard to the agents employed in accomplishing the preservation of subjects, gave information as to quite a large number employed and in various combinations. An analysis shows that of the agents used carbolic acid stands first, and that it was used not alone but in combination with other agents. Glycerine was reported as an ingredient in the next highest number. It was also employed in combination with other agents. The next in frequency was reported to be arsenic, and this agent was used also in combination. Chloral hydrate and chloride of zinc and bichloride of mercury come next in the order of use. Alcohol, either pure or in combination, carbonate of potassium, bicarbonate of sodium, chloride of sodium, methyl spirit, formalin, nitrate of potassium, brown sugar, boric acid, were reported as used in numbers varying from four to one. The preservation of subjects by cold storage was reported in five instances. Some of the agents above noted were used in combination to preserve the subject, which had been kept in cold storage after it was placed upon the table for dissection. In one instance the following plan was reported : Injection with carbolic acid one and a half pints, glycerine six pints, with alcohol one and one-half pints. After the injection, directions were given to paint the subject daily for fourteen days with carbolic acid one part to glycerine six parts, and then place it in an air-tight box over a pan of methylated spirits. Perfectly satisfactory results were reported to have been obtained by this method, both as regards the character of the tissues and the absence of odor. Subject keeps indefinitely. Chloride of zinc, a fifty per cent. solution of neutral reaction was reported as an agent used successfully in preserving subjects, but had the objection of unfavorable action on the tissues, causing hardness and change in color. If subject is not required for immediate use it was placed in a saturated solution of salt, forming a strong brine. If immersed for a long time in the brine the subject requires to be soaked in water for a period of twenty-four or forty-eight hours, in order to soften the tissues.

A number of formulæ were given, among them Wickersheimer's formula, consisting of three thousand parts of boiling water, one hundred and nine parts of alum, twenty-five parts of chloride of sodium, twelve parts of nitrate of potassium, sixty

parts of carbonate of potassium, ten parts of arsenious acid ; when cool, filter, and to ten parts of the liquid thus obtained add one part of methylic alcohol and four parts of glycerine.

Van Vetter's formula : Seven parts of glycerine, one part of brown sugar and one-half part of nitrate of potassium.

Langer's formula : One hundred parts of glycerine, fifteen parts carbolic acid, eleven parts of alcohol.

Empersonne's formula: Chloral hydrate five hundred grains, glycerine two and a-half litres, and distilled water.

Among the formulæ reported, arsenic was an ingredient in a large number, and in the following combinations: 1. Arsenic (pure) eleven and one-half pounds, carbonate of potassium twenty-one pounds, crude carbolic acid and glycerine each two pints, with distilled water sufficient to make one gallon. 2. One pound of arsenic, one pound of bicarbonate of soda, one pint of salt, six quarts of water. 3. Injection of arseniate of potash, mixed in large quantity with liquid soap. 4. Arseniate of soda, in saturated solution, one gallon ; carbolic acid, eight ounces ; glycerine, one half pint. The above formulæ afford examples of the use of arsenic, either in the form of arsenious acid, arseniate of potassium, or arseniate of sodium. As a rule, it was combined with some salt of potash, carbolic acid and glycerine. In a few instances it was reported as being used alone in solution.

Carbolic acid appears in a large number of the formulæ reported in use. In most instances in combination with arsenic, some salt of potash or soda or bichloride of mercury. In a few instances it is reported as being used alone.

Bichloride of mercury is also reported as largely used alone or in combination with arsenic, salts of potash or soda, carbolic acid and glycerine ; one formula being one five hundredth solution of bichloride of mercury in mixture of water, glycerine and alcohol ; another, a mixture of bichloride of mercury, glycerine, carbolic acid and spirit. The bicarbonate of potash, bicarbonate of soda, nitrate of potash, as well as the chloride of sodium, appeared in a number of the combinations employed. They are not reported as possessing sufficient preservative power which would permit them to be used alone.

Glycerine appears to be a favorite agent, as it forms a part of a large number of formulæ. The same may be said, in a very less degree however, with regard to the use of alcohol.

Formalin is reported in two instances, in one of which it was used in connection with the preservation of human subjects, and another in the preservation of an animal. In the latter instance the agent was used in the proportion of one part to two hundred

parts of water. The animal was injected with the solution thus prepared and the body was placed in a tank with a large quantity of fluid which was changed after a period of one week, then after a period of three weeks and strengthened from time to time by the addition of a little formalin. Experience obtained in this case was that, to make the injection of this agent effective, the body should be thoroughly injected, washing out the blood if possible, and if the body is not to be dissected at once it should be placed in a receptacle capable of being sealed up to prevent the escape of formalin, and to prevent the formation of mould it should at all times be covered by the solution. The cost of the formalin was stated to be \$1.65 per pound package for a forty per cent. solution.

5. As to the point in which injections were made there were reported two in the heart, nineteen in the common carotid artery, and six in the common femoral artery. As to the condition of the tissues after injection but few replies were received and these were not satisfactory. With regard to the time in which material can be kept and used in dissection, the replies include periods from three weeks to one year. Five reported having used or were using the method of preservation by cold storage, the cost of the plant being from \$500 to \$3,000.

6. The cost of receiving and preserving material is stated to be from \$1 to \$25 per subject.

7. In fifteen cases the supply of material is stated to be sufficient and in fifteen not sufficient. In a number it was stated to be adequate, but more could be used if obtainable. The number of students were reported as assigned to each subject to vary from four to sixteen.

While the committee feels that the information gathered through the circular letter was not in some respects sufficiently specific to enable it to arrive at definite conclusions upon the subject under consideration, yet it believes that certain statements may be made and conclusions deduced which will be of value to teachers of anatomy and those interested in the collection and preservation of anatomical material.

The committee regards it in every way as a matter to be most favorably commented on that out of the 42 replies from institutions 30 contained information that anatomical material was obtained for the purposes of instruction under the provisions of the law. An examination of the copies of the law which were sent to the chairman of the committee shows them to be defective in many respects, giving evidence in the provisions incorporated in the laws of a strong feeling on the part of legislators against the

enactment of laws controlling the disposition of dead human bodies for the purpose of dissection. This feeling has no doubt its origin in a fear that by so doing they will expose themselves to criticism, if not to censure, by their constituents. This sentiment it believes can be largely changed by the influence exerted upon the public mind by the members of the medical profession. In every community it should be the effort of the medical profession to educate public opinion upon this point; to place before the public the great necessity which exists for the use of dead human bodies in providing the proper instruction of students in medicine, and the great protection afforded the citizens in each State by the enactment of laws which will regulate the supply of anatomical material and thus afford protection to the dead and prevent the desecration of their resting places.

With regard to the protection which a properly framed law affords to the community, it may be stated that it is within the information of the committee, and also it may be said of the public, that the body of a member of the family of one of the highest officers of the land was found in the dissecting room of a medical college. In the State in which this family resided there was at that time no Anatomical Law in existence. Since then one has been enacted, and the repetition of such an occurrence as that referred to is not possible under its provisions.

Since the preparation of this report was begun it has been reported in the daily papers that a physician residing in one of the Western States has been convicted of the desecration of a grave, by the removal of the body which it contained, and which was to be used for dissection, and has been sentenced to imprisonment for a term of three years. In the State in which this occurred there is, so far as the committee knows, no law governing the use of dead human bodies for the promotion of medical science. These instances afford, the committee thinks, in a very forcible manner, evidence of the protection which would be furnished to both the community and the profession by the provisions of a properly framed Anatomical Law. Attention has been called to the fact that in a number of existing laws their provisions on examination were found to be defective. In some instances they were so inadequate as to render the execution of the law practically impossible, and in other cases to make the law inoperative.

nt the committee feels it proper to express an opinion
t that the requirements of any law which is to be en-
d be made compulsory, and not optional, as to per-
duty on the part of public officers. It thinks that
ience has been obtained in the effort to secure

compliance with the terms of Anatomical Laws to make it evident that under such conditions only can the proper supply of anatomical material be obtained. In any law enacted it also believes that proper protection should be afforded the public as well as the profession in strict specification as to the right of claim for burial. This right should be limited to relatives either by blood or marriage.

In this way claims made by organizations and individuals moved by feelings of sentiment would be disposed of. In almost all States, if not indeed in all, legal provisions are in force which control the burial of the bodies of certain individuals, notably war veterans.

With regard to any other claims by organizations or individuals, it would be proper to leave them to the discretion of those having charge of the execution of the requirements of the law. A spirit of conciliation and a regard for public sentiment should always actuate those concerned in the execution of the law, in order, so far as possible, that any feelings of antagonism or hostility should be removed. As stated above, it should be the duty of members of the medical profession to educate public sentiment, and obtain in every State enactment of a law which will control the use of dead human bodies for the promotion of medical science. At this time of writing the daily papers contain an account of the action by the Governor of a Western State, who has been compelled to call upon the military force to protect a medical college, which has been threatened by a mob. In this case the trouble has been caused by the discovering in the dissecting room of the college of bodies removed from a cemetery adjacent to the city in which the college is situated. Here is plainly made manifest the necessity of a law to protect both the public and the profession. An examination of the laws now in force in the States in this country leads the committee to the belief that the law of the State of Pennsylvania is the best, in the fact that it includes in its terms all the provisions necessary to compel compliance on the part of public officers and to protect the citizens of the Commonwealth in all of their rights. It is also observed in the examination of the laws of other States that many of them have been founded upon this law, but in no instance have all of the provisions of the law been incorporated. This is possibly to be expected, as the conditions existing in each State control the actions of the legislative bodies in the framing of laws. A copy of the law of the State of Pennsylvania is appended to this report, and may be examined by the members of the Association.

With regard to the disposition of the remains left after dissection, the committee feels it proper to advise that so far as possible they should be decently interred. Under any circumstance the committee thinks that it is not in keeping with the proper sentiment to dispose of them in the manner in which it is feared it is sometimes done. The retention of bones in some instances for the purpose of study and instruction and for the preparation of articulated skeletons is necessary and sanctioned.

With regard to the preservation of anatomical material by the injection of chemical agents or by cold-storage method, the committee feels that the information received is not as specific and comprehensive as desired. The agents reported to be in use, either alone or in combination, are such as are well known to the teachers of anatomy. There is apparently no conclusive evidence that any one of the agents alone, or in combination, accomplishes all that is desired in the way of the perfect preservation of anatomical material. Perfect preservation includes not only freedom from decomposition, but the maintenance of the tissues in a normal condition as nearly as possible, and the existence of these conditions for such length of time as may be necessary in the storage of subjects on one hand and the time required for the work of actual dissection on the other hand. In many institutions it is necessary to collect during a period of the year, and that the most unfavorable season, so far as temperature is concerned, a number of subjects which shall be kept in a state of preservation for a number of months, so that they may be, in every respect, suitable for dissection. To accomplish this it is necessary to employ an agent which will not only prevent decomposition, but also to provide some means to so keep the subject that it may be maintained in this condition of preservation without material change in the color or character of the tissues. These ends are to be obtained, it is also to be observed, within what may be regarded as a reasonable cost. To accomplish the latter object it is manifest that one agent should be used rather than a combination of agents. For instance, the use of arsenious acid or bichloride of mercury, both of which are inexpensive, will provide a means of preservation at no very great cost. When these agents, however, are used in combination with glycerine, rectified spirits, or methylic alcohol, the cost will be materially increased, and the storage of the subjects, thus injected, in alcohol or other agent of similar character, will add to the expense.

The committee is not able to say from the information received that any of these agents will preserve anatomical material for a

number of months. Undoubtedly solutions of bichloride of mercury, arsenic or carbolic acid, will prevent the occurrence of decomposition for a limited period of time, sufficient under ordinary circumstances for the complete dissection of the subject, but no evidence was adduced that these agents, when injected into a subject which was to be stored in a saline solution for a number of months, would be effective. The use of salts of potassa is advised in a number of instances, and, as is well known, they are of value in combinations, the effect being not only in a slight degree preservative, but is also manifest on the color of the tissues. The use of arsenic solutions is objected to by students on account of the irritation of the fingers which is produced. While there may be a few instances in which this objection becomes a matter of serious importance, it may be regarded as of minor importance in the great majority of cases. The objection against the use of glycerine is the production of mould, which occurs as the result of the hygroscopic action. The expense attending the use of alcohol is such as to forbid its employment in any large quantity for injection or storage purposes. Formalin is reported as effective as a preservative and storage agent, but its cost is a strong objection against its use. The committee believes that the method of preservation by means of cold storage is the best which could be employed, but the question of expense of the introduction of a plant necessary for this purpose is a very serious one. In cities where more than one medical institution is situated, it seems feasible to have a central plant in which subjects required in all the institutions can be stored, with the division of expense made amongst those entering into the arrangement. As to the time in which subjects should be injected which are kept in cold storage plants, it is desirable that this should be done prior to their deposit. They will be ready to place at once upon the table, and it is believed that the injections can be better made before deposit than after they have remained some time under the influence of the cold.

Reference is made to the use of the solution of chloride of zinc as a preservative agent of value, especially where it is necessary to collect subjects during the summer months, and to keep them in a solution of a salt. Solutions of chloride of zinc will, without doubt, not only prevent but arrest decomposition. The bleaching properties which it possesses and which it exerts upon the tissues are a very serious objection. This agent is used largely, if not altogether, in the medical institutions of Philadelphia, to which are supplied each year over seven hundred subjects. It is used as an injection in the proportion of one-half to

one-third of a fifty-per cent. solution of neutral reaction, a subject of average weight requiring from four to six quarts.

In the replies given as to the cost of the reception, preservation and injection of subjects a wide difference is observed. It is evidently impossible, unless subjects are transported without cost, to reduce the cost per subject for reception, injection and preservation to \$1.00 each. Under the provisions of a well framed law, it is believed that the delivery of subjects should not exceed on an average from \$5.00 to \$8.00, and the injection and preservation should be accomplished by an additional expenditure of \$5.00, making the cost of each when placed upon the table about \$12.00.

Less than one-half of the replies received as to the supply of anatomical material contained the statement that the supply was adequate. In an equal number the supply was stated to be not sufficient and the remaining number reported that more subjects could be used if obtainable. The conclusion to be deduced from these statements is manifestly to the effect that the supply of anatomical material in our medical institutions is not as great as it should be.

The number of students assigned to each subject was stated in the replies received to vary from four to sixteen. Here again, it is to be observed, a wide difference is expressed; the number on one hand being too small to obtain the proper economy in the use of material, and on the other hand too large to secure the full instruction necessary. It is to be observed that the manner in which instruction is imparted will modify the statements above made.

CONCLUSIONS.

1. Anatomical material for the promotion of medical science should be obtained wholly under legal enactment. The provisions of the law should be compulsory upon all officers of State and county institutions and municipal governments.

2. Of the anatomical laws which are in force in this country, the committee is of the opinion that the law of the State of Pennsylvania is the best. It is framed in such manner as to provide under a strict execution of its requirements anatomical material for the promotion of Medical Science and prevents the desecration of the resting place of the dead.

3. The committee believes it would contribute to the best interests of anatomical teaching in this country if action was taken by this association to secure the enactment in every State of a

law controlling the collection and distribution of anatomical material, and recommends such action.

4. The committee finds itself unable, from the information which has been received, to arrive at any definite conclusions with regard to the best means for accomplishing the preservation of anatomical material for the purposes of dissection. Many of the agents reported in the communications received have been long in use, and to a greater or less degree have been employed successfully in securing preservation of anatomical material, but not with all the conditions which are deemed essential in perfect preservation, and those which afford the best results in dissection. Preservation by means of cold storage it believes to be the method which approaches nearest to perfection, and it should be arranged upon such a plan as will admit of the retention of anatomical material, under the influence of the low temperature during dissection.

(Signed,)

J. EWING MEARS,
J. D. BRYANT,
THOMAS DWIGHT.

NOVEMBER 19, 1895.

The following additional recommendation was adopted :

5. That Professors of Anatomy be requested to inform their students concerning the laws upon the subject of anatomical material, and request these students to use their influence with the authorities in their respective places of residence to increase the quantity of anatomical material by making available much that is now withheld, either from neglect or indifference.

ANATOMICAL LAW OF THE STATE OF PENNSYLVANIA, ENACTED JUNE
13, 1883.

For the promotion of medical science by the distribution of and use of unclaimed human bodies for scientific purposes through a board created for that purpose, and to prevent unauthorized uses and traffic in human bodies.

SECTION I. *Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania, in General Assembly met, and it is hereby enacted by the authority of the same:* That the professors of anatomy, the professors of surgery, the demonstrators of anatomy, and the demonstrators of surgery of the medical and dental schools and colleges of this Commonwealth, which

are now or may hereafter become incorporated, together with one representative from each of the unincorporated schools of anatomy or practical surgery within this Commonwealth in which there are, or from time to time at the time of the appointment of such representative shall be, not less than twenty-five scholars, shall be, and hereby are constituted a board, for the distribution and delivery of dead human bodies hereinafter described, to and among such persons as under the provisions of this Act are entitled thereto. The professor of anatomy in the University of Pennsylvania at Philadelphia shall call a meeting of said board for organization at a time and place to be fixed by him within thirty days after the passage of this Act. The said board shall have full power to establish rules and regulations for its government, and to appoint and remove proper officers, and shall keep full and complete minutes of its transactions, and records shall also be kept under its direction of all bodies received and distributed by said board, and of the persons to whom the same may be distributed, which minutes and records shall be open at all times to the inspection of each member of said board, and of any district attorney of any county within this Commonwealth.

SEC. 2. All public officers, agents and servants, and all officers, agents and servants of any and every county, city, township, borough, district and other municipality, and of any and every almshouse, prison, morgue, hospital, or any other public institution having charge or control over dead human bodies required to be buried at the public expense, are hereby required to notify the said board of distribution, or such person or persons as may from time to time be designated by said board, or its duly authorized officer or agent, whenever any such body or bodies come into his or their possession, charge or control, and shall, without fee or reward, deliver such body or bodies, and permit and suffer the said board and its agents, and the physicians and surgeons from time to time designated by them, who may comply with the provisions of this Act, to take and remove all such bodies to be used within this State for the advancement of medical science; but no such notice need be given, nor shall any such body be delivered if any person claiming to be and satisfying the authorities in charge of said body that he or she is of kindred or is related by marriage to the deceased, shall claim the said body for burial, but it shall be surrendered for interment, nor shall the notice be given or body be delivered if such deceased person was a traveller who died suddenly, in which case the said body shall be buried.

SEC. 3. The said board, or their duly authorized agent, may

take and receive such bodies so delivered as aforesaid, and shall, upon receiving them, distribute and deliver them to and among the schools, colleges, physicians and surgeons aforesaid, in manner following: Those bodies needed for lectures and demonstrations by the said schools and colleges, incorporated and unincorporated, shall first be supplied, the remaining bodies shall then be distributed proportionately and equitably, preference being given to said schools and colleges, the number assigned to each to be based upon the number of students in each dissecting or operative surgery class, which number shall be reported to the board at such times as it may direct. Instead of receiving and delivering said bodies themselves, or through their agents or servants, the board of distribution may, from time to time, either directly, or by their authorized officer or agent, designate physicians and surgeons who shall receive them, and the number which each shall receive. Provided always, however, that schools and colleges, incorporated and unincorporated, and physicians or surgeons of the county where the death of the person, or such person described, takes place shall be preferred to all others. And provided, also, that for this purpose such dead body shall be held subject to their order in the county where the death occurs for a period not less than twenty-four hours.

SEC. 4. The said board may employ a carrier or carriers for the conveyance of said bodies, which shall be well enclosed within a suitable encasement, and carefully deposited free from public observation. Said carrier shall obtain receipts by name, or, if the person be unknown, by a description, for each body delivered by him, and shall deposit said receipt with the secretary of the said board.

SEC. 5. No school, college, physician or surgeon shall be allowed or permitted to receive any such body or bodies until a bond shall have been given to the Commonwealth by such physician or surgeon, or by or in behalf of such school or college, to be approved by the Prothonotary of the Court of Common Pleas in and for the county in which such physician or surgeon shall reside, or in which such school or college may be situate, and to be filed in the office of said Prothonotary, which bond shall be in the penal sum of one thousand dollars, conditioned that all such bodies which the said physician or surgeon, or the said school or college, shall receive thereafter shall be used only for the promotion of medical science within the State; and whosoever shall sell or buy such body or bodies, or in any way traffic in the same, or shall transmit, or convey, or cause to procure to be transmitted or conveyed said body or bodies to any place out-

side of this State shall be deemed guilty of a misdemeanor, and shall, on conviction, be liable to a fine not exceeding two hundred dollars, or be imprisoned for a term not exceeding one year.

SEC. 6. Neither the Commonwealth, nor any county or municipality, nor any officer, agent, or servant thereof, shall be at any expense by reason of the delivery or distribution of any such body, but all the expenses thereof, and of said board of distribution, shall be paid by those receiving the bodies, in such manner as may be specified by said board of distribution, or otherwise agreed upon.

SEC. 7. That any person having duties enjoined upon him by the provisions of this Act, who shall neglect, refuse or omit to perform the same as hereby required, shall, on conviction thereof, be liable to fine of not less than one hundred nor more than five hundred dollars for each offence.

SEC. 8. That all Acts or parts of Acts inconsistent with this Act be and the same are hereby repealed.

PHILADELPHIA, *January 1, 1889.*

In accordance with the requirements of the above law the Anatomical Board of the State of Pennsylvania was organized July, 1883, for the purpose of carrying it into execution. The attention of all State, county and municipal officers charged with duties under the law is directed to its requirements. Boxes containing bodies should be addressed to George Willie, Philadelphia, and should be delivered to the agent of the express company at the station nearest to the place from which the body is sent. The charges paid by the board for transportation to the railroad station vary from \$1 to \$2.50, in accordance with the distance. These charges will be paid by the agent of the express company, and collected from the Board by the agent in Philadelphia.

DISCUSSION ON ANATOMICAL MATERIAL.

DR. HOLMES said that he thought the clause regarding Medical Schools should be made very much stronger. A little more could be done than the committee had recommended. Teachers in Medical Schools should inform the students in regard to the laws pertaining to the obtaining of anatomical material. It might even be well for the teacher of anatomy to read the law of the State on the subject to the students. The trouble with our students is that they never give a thought as to how the material

is obtained so long as they get it. Gentlemen had told him that if they had known, they could have influenced certain persons in the hospitals in their own community and have gotten material sent to us. He was informed that in his own state (Pennsylvania), New Jersey and other States there were a number of Italians who had neither name nor home, who died and were simply buried by number. If this material could be sent to us it would help us very much. He would further suggest that the professors in the various schools be requested to make formal announcement to the students each year.

DR. DWIGHT thought very much as Dr. Holmes did, and every year had done very much as suggested. It was in the first year that the men had crude ideas of dissection, and he thought it very important to impress upon the class even more than Dr. Holmes suggested; at the same time he might say that the hospital authorities did not quite agree with Dr. Holmes. His observation was that they did not care. They simply wished to do nothing that would endanger their own position.

DR. WILDER said: I suggest that reprints of this report be sent not only to purely medical journals, but to scientific and even lay journals which may be expected to deal with the matter in a reasonable way and aid the diffusion of the information and views therein contained.

As to the preservation of bodies, from an experience of more than 27 years, we (at Cornell) are pretty well wedded to the use of alcohol. An exception, however, exists in respect to the brain, for which we prefer a mixture of formalin, zinc-chloride and salt, devised by Dr. P. A. Fish:

Water, 2,000 cc.; formalin (40 p. c. commercial), 50 cc.; sodium chloride, 100 grams; zinc chloride, 15 grams. The specific gravity, about 1.05, supports the brain without distortion. After 7 to 10 days the specimen is transferred to a mixture of water 2,000 cc. and formalin 50 cc., in which it may remain indefinitely, but for museum purposes the liquid is replaced by alcohol (50, 70 and 90-95 p. c.) at intervals of a few days. See Fish's paper, "The Use of Formalin in Neurology." *Amr. Micros. Society, Transactions*, 1895, p. 325.

There are two objections to alcohol, first the cost and second the bleaching of the tissues. This, however, does not interfere with the recognition of the structure and connections of the parts, and the student merely needs to bear in mind that the parts are not natural in color, and compare in that respect with the plates in certain books, to dispel any wrong impression he may have gained. An alcoholic specimen may be preserved indefinitely,

and may be kept in good condition for dissection by simply covering it with cloth. Hence the dissection may be continued day after day until the student has learned all that can be learned from it. I am disposed to believe that alcohol is all-sufficient, especially if the contents of the intestines are washed out, as is done with our cats prepared for practicum purposes. The cost of alcohol for the injection of subjects is not to be regarded as excessive, in view of the better results which can be obtained by its use, and we are encouraged by chemists to believe that alcohol is going to be cheaper; moreover, medical schools may get it free of tax. The preservation of the brain should be accomplished more generally and thoroughly, and the organ should be removed early; it should not be sacrificed to the occipito-frontalis muscle, or any other part of the head. It should be preserved in such a way that when the student is ready it will be in a condition to be of use. Perhaps there has been improvement in this respect since I was a student. I would like to ask Prof. Gerrish whether he has found it practicable to obtain material under the law for a school for medical instruction not coming under the head of medical colleges. The statutes in New York have been modified so that any institution giving a preparatory course in medicine may obtain, under the law, material for dissection.

DR. GERRISH said: At the Maine school we procure a large part of our material from exotic sources—we have to send to distant places and hire men to break the law of their States in our interest. We get some subjects in the domestic field, but have great difficulty on account of the peculiarity of the statute relating to this matter. The law permits the school to have the bodies of those whose family or next of kin do not claim them for burial unless ten legal voters request the municipal officers of the town to have such bodies buried at the public expense. Thus it commonly happens that a person who has been a pauper or even a criminal for many years excites more sympathy when dead than when alive, and is interred at municipal cost, instead of being devoted to the cause of science.

DR. WILDER said: I should like to ask Dr. Huntington if he has tried a preliminary injection of alcohol and then cold storage. I desired to know if alcohol was not pleasanter to work with than arsenite of soda.

For several years I have been endeavoring to lead the public to recognize the desirability of devoting to the interest of science the brains of educated and moral people. The consent of such persons themselves and of their relatives to this use of the brain

is perhaps the entering wedge, and constitutes, the most natural and least objectionable method of reconciling the public to the use of the entire body. The success of my efforts may be seen from the statement that in my neighborhood I have obtained the brains of not less than eight persons who were more or less notable in the community. The last case was almost startling. A brother and sister signed the blank "Form of Bequest" which I keep on my desk. They were students in our University at that time and each witnessed the other's signature. Before graduating, the lady married a gentleman with whom I had no acquaintance. When she died I remembered that this was one of the persons who had promised me their brains, but made no move in the matter. Through a mutual friend, however, I was informed that she had told her husband of the bequest and that he would interpose no objection.

The newspapers are not told about such cases at present, lest they give rise to sensational articles. I have with me the brain of one of my colleagues obtained with the consent of his wife. If such instances can occur, it seems to me that we may be able eventually to reconcile the public to the dissection of the whole body under certain restrictions.

DR. BEVAN said: I would like to mention here a method which I have found quite satisfactory. It is a combination of cold storage and an injection of alcohol, glycerine and bichloride of mercury. Each body receives from three to four quarts of alcohol, three pints of glycerine and four ounces of bichloride. One practical point in regard to cold storage, and which I believe is not carried out elsewhere; is our method of handling the bodies in cold storage. I have a pair of ice tongs made to fit in the external auditory meatus, and the bodies are suspended in this way. I am quite convinced that this little method has a good deal of service in it. The tongs are made by blacksmiths for about one dollar each and they give great satisfaction.

In regard to the preservation of brains, an idea which was given to me recently by Professor Hektoen is that of preserving in formalin and Müller's fluid. The brain hardens very rapidly and within a few days specimens for class demonstration can be made. The color produced is the best I have seen, and it is possible to differentiate between the gray and white matter at a distance of fifty feet. I use 5 per cent. of formalin in Müller's fluid. I have experimented with many methods, and I am rather convinced that this is better than the alcohol method. We use an ordinary earthen-ware jar with a cover, and simply sufficient fluid to immerse the

brain. It is suspended with a mosquito bar around the edge of of the jar. It does not change shape as in the other methods which I have employed and there is no shrinkage. In a cross section of the ventricle, you will find the exact normal form of the ventricle. In some cases you will find the ventricular cavity obliterated by other preservatives. The specimen would float without the mosquito bar.

DR. HOLMES said: As to the use of alcohol, glycerine and bichloride of mercury in bodies which are advanced in decomposition, I would like to ask for information. Our bodies are kept at least 24 hours before they can be turned over to the Anatomical Board, and it is often 36 to 48 hours after this before we get them. The advantage of chloride of zinc is that it will arrest putrefaction while the other methods are good only when the body is fresh. It is easy to make fancy preparations when you get the body early, but it might not be applicable for general use in the dissecting room, and I, therefore, would like to know about this. We have no choice of material here and have to take all we can get. It is on this account that we use chloride of zinc, and I would like to know if the method suggested is applicable to the bodies that are not fresh.

DR. BEVAN: We cannot obtain any of our material until four days after death, but if you take a body that is green and use this method you can entirely clear up this green discoloration. A body is rarely kept on our dissecting tables longer than 6 or 7 weeks. With this material, too, we have no odor. The only odor we have in the room is from an occasional post mortem cadaver which can not be well injected. I have used this method for three years with satisfaction. Then again we have no dissecting wounds except those traceable to post mortem cadavers not injected with this solution.

DR. WILDER considered this an important point in favor of alcohol. Few students are trained dissectors, and hence the thorough examination of parts takes considerable time.

DR. GERRISH said: It seems to me that it would be well to send a copy of this report to all the medical schools in the country. It would give very desirable information, not only in respect to the law, but with reference to other matters in which teachers of anatomy are interested. We would like to have all the teachers of anatomy members of this Association. If a copy of this report were sent to every one of them in the country it would simplify matters and attract the favorable attention of non-members to the work which we are doing.

MYOLOGY OF THE EXTREMITIES OF LEMUR BRUNEUS.

BY DR. GEORGE S. HUNTINGTON, PROFESSOR OF ANATOMY, MEDICAL DEPARTMENT, COLUMBIA COLLEGE, NEW YORK CITY.

Dr. Huntington's paper, which was illustrated by drawings and casts, has not been received. The following remarks were made by Dr. Wilder :

I am extremely interested in Dr. Huntington's paper, and may be permitted a brief personal reminiscence.

More than twenty-five years ago, while preparing a course of lectures on "Hands and Feet of Mammalia," I ventured to ask the late Professor Agassiz to lend me some forms not otherwise obtainable. He responded most generously, and among other things he gave me a lemur (*Galago*), which I dissected and still retain. I do not now recall the condition of the *pectoralis minor* in this specimen. Its origin extends from the 6th costal cartilage to between the 1st and 2d.

Since the *pectoralis minor* is actually larger than the *pectoralis major* in most mammals, its entire absence in this lemur is very impressive as illustrating the variability of the group. In view of the alleged human resemblances of the dentition of the fossil lemuroid, *Anaptomorphus* (Cope) and the departures from the human type presented by the cerebral fissures of the ordinary monkeys, there should not be ignored the possibility of phyletic relationship between the highest and the lowest of the primates. If Dr. Huntington will let me study the brains of his lemurs, the muscles of my specimens shall be at his disposal. In this connection will he state whether he has found in any lemur a representation of the *peronæus tertius*?

Since, in place of *pectoralis major* and *pectoralis minor*, Dr. Huntington has frequently said "superficial" and "deep pectoral," he may not be indisposed to follow Owen's example with regard to the gluteal muscles (ecto-, meso- and entoglutæus) and use the locative mononyms, *ectopectoral* and *entopectoral* advocated by me in 1873 (*Amer. Assoc. Adv. Sci., Proceedings, XXII, 306*).

ABSENCE OF FIBROUS PERICARDIUM OF LEFT SIDE.

BY DR. ADDINELL HEWSON, DEMONSTRATOR OF ANATOMY,
JEFFERSON MEDICAL COLLEGE, PHILADELPHIA, PA.

Dr. Hewson's paper, which was illustrated by the dissection itself, has not been received. The following discussion took place :

DR. WILDER: I am interested in Dr. Hewson's account of this extraordinary specimen, which, as he says, he rescued from the hands of an unappreciative student. The first case that ever was known, so far as I am aware, of a mammalian brain showing the absence of the callosum, was that of a cat which was in the hands of a student in my laboratory sixteen years ago. He had medisected it and was about to make a drawing merely to show that it was not exactly like the book.

Professor Minot tells me that one of the subjects in human anatomy, which is not adequately represented in the books, and which, in conjunction with another anatomist, he is attempting to work up, is the precise structure of the diaphragm and its relation to other parts. It is probable that he may be able to throw some light on such a case as this.

DR. DWIGHT: The case interests me as to the line of the posterior fold of the pericardium. The posterior veins are inside of it. I am inclined to think that the adhesion at the apex is an entirely accidental one, probably extra-uterine.

DR. BEVAN: I wonder if such a condition would follow traumatism, a rupture of the pericardium, with subsequent adhesion. It looks as if it might have been caused in this way.

THE DESCRIPTIVE ANATOMY OF THE HUMAN HEART.

BY DR. WILLIAM KEILLER, F. R. C. S. ED., PROFESSOR OF ANATOMY, UNIVERSITY OF TEXAS.

[In the absence of Dr. Keiller, this paper was read by Dr. Gerrish. It will be published with illustrations in the *American Journal Medical Sciences*.]

The magnificent work of Braüne and His has within the past decade revolutionized many sections of descriptive and topographical human anatomy. Till lately, dissection of the fresh

or imperfectly prepared subject was the only means used to arrive at a knowledge of the form and relations of each structure, but within recent years the examination of the body made while frozen, and the dissection of subjects hardened to comparative rigidity by continued intra-arterial infusion of such hardening agents as chromic acid, chloride of zinc, or corrosive sublimate, have corrected grave errors which had arisen from the exclusive study of the organs in the flaccid condition met with when ordinary methods are used.

Even on the post mortem table, and within thirty-six hours of death, the liver, spleen and heart "flop" out of all shape (I can think of no more expressive word, if it be somewhat inelegant), and are no more like the same organs as seen when hardened *in situ* than the jelly fish, half embedded in the sand, a shapeless and repulsive mass, resembles the living embodiment of symmetry and beauty propelling itself through the clear blue water. What then must be the condition of the same organs weeks or months after death, in bodies preserved by freezing, or by arsenical solutions which do not harden the tissues? Verily such organs are the despair of the medical student, and those who have never seen hardened organs may well be excused should they regard the models of His and allied descriptions with a certain amount of respectful incredulity. Such, I confess, was my own feeling toward them, till, on the adoption of my present method of preserving bodies, I found to my surprise that these and other organs were thereby sufficiently hardened to present almost perfect counterparts of these models, without any interference with the methods of dissection. Thus there is now in my dissecting room scarcely a liver, kidney or spleen removed by the student from his subject that does not exhibit in perfection all the surfaces, borders and impressions described and modeled by His.

While the text book descriptions of liver, kidney and spleen have been changed to accord with recent views, it is somewhat strange that the heart is still portrayed as it used to be many years ago, though it requires the most vivid imagination and elastic conscience to reconcile the description with the accepted model of His; and this is still more strange since clinicians have found the text book description of the organ so utterly inadequate that they have had to invent terms of their own in order to indicate anatomical facts in the living, terms which have no place in the dissecting room vocabulary. I have long felt that though the description of the heart as presenting a base, apex, right and left borders, and anterior and posterior surfaces, is sufficient to describe the flabby shapeless mass one finds on the

post mortem table when the excised organ is there before one, yet it is useless as applied to His's model or my own specimens hardened *in situ*. I have therefore for the past few years described in my lectures what I saw before me, without reference to the text book; and I feel that the matter is of sufficient importance to merit presentation to my brother anatomists. When I consider that my own description is immensely more complex than that now in vogue, I feel some little compunction in suggesting an additional burden to the already sorely laden student of anatomy, but I am encouraged by the remembrance of what has happened in the case of the liver.

That organ, which in the primitive simplicity of old text book descriptions has only two borders, two surfaces, and no impressions at all, has now five borders, as many surfaces, and eight impressions; but everything is so definite, its relations are so evident, and the picture can be so vividly printed on the brain, that what was before a pure matter of memory and a puzzle to the student is now easily described and readily understood and remembered.

First let me allude to the inconsistencies in our accepted descriptions. The pericardium is spoken of as cone-shaped, its apex upwards, its base resting on the diaphragm. Yet the heart which, with the commencement of the great vessels, completely fills it, is described as a cone with its apex directed downwards, forwards and to the left, and its base upwards, backwards and to the right. But this is a small matter, and probably justifiable; graver inconsistencies are to come.

Clinical manuals, such as Gibson Russell's "Physical Diagnosis," and articles on Topographical Anatomy, such as that in "Morris's Treatise," discard the word "base," or explain that in their use of it they mean the "upper limit;" use "lower border" to signify what, in the dissecting room, we call the "left border;" apply the term "right border" to what, in the dissecting room, we do not describe at all, and their "left border" is anything but synonymous with the left border of the descriptive anatomist.

Having, I trust, succeeded in showing that some change is necessary, I shall endeavor to submit to you a description of the external configuration and relations of the human heart, which shall be accurate, concise, and free from redundancy. I would ~~beg~~ that those who honor my description when in print with a perusal, will compare it and the illustrations with the by His, and those who desire to verify it in the dissecting may do so in any body injected through the right common d or femoral artery with a gelatine injecting mass. The

drawings are made from a rather enlarged specimen, of which the right side was filled with coagulated blood and the left side with injection mass; but though large it agrees in all essential matters with His's model and many other dissecting room specimens I have carefully examined. My description is markedly borne out by vertical sagittal, mesial and coronal sections of the frozen body; horizontal sections I have not yet been able to compare it with.

Thus viewed, the heart is an irregular four-sided pyramid, whose base rests on the diaphragm, and whose apex has been, as it were, removed to afford attachment for the ascending trunks of the great vessels. It thus presents for examination five surfaces (including the base), borders separating these, an anatomical apex, and a "clinical apex," a term which I feel compelled to retain because it is almost inseparable from physiological and clinical phraseology.

The *anterior surface*, the first which meets the eye when the chest and pericardium are opened, is triangular in shape, slightly convex, and is directed forwards and a little upwards, being in sagittal mesial section parallel with the sternum. It includes a greater part of the right ventricle and portions of the left ventricle, left auricular appendix, the whole right appendix and part of the right auricle. It is bounded below by the sharp, almost straight antero-inferior border (*margo acutus*), on the left by the oblique, convex, and slightly rounded left anterior border (the left border of clinicians), and on the right by the nearly vertical and convex right anterior border (the "right" border of clinicians). Its superior angle marks the anatomical apex, and here the surface merges on the anterior walls of the aorta and pulmonary artery. Its left inferior angle forms the clinical apex. On this surface are seen the anterior or right coronary artery in the anterior auriculo-ventricular groove, while its marginal branch runs along the antero-inferior border; and in the anterior interventricular groove is the descending branch of the posterior or left coronary artery, accompanied by the great cardiac vein. *Relations.*—Separated from it by the pericardium are the margins of the lungs and pleurae, the sterno-pericardial ligaments, triangularis sterni, internal mammary vessels and sternum.

The *right surface* is markedly convex, four sided, is almost vertical, and is directed toward the right. It includes the greater part of the right auricle. Its anterior, posterior and inferior borders are only slightly rounded, and are therefore fairly well defined. At its superior extremity the surface blends with the wall of the superior vena cava, and at its posterior inferior angle it is

similarly related to the vena cava inferior. *Relations*.—It is separated by pericardium from the right phrenic nerve and vessels, pleura, and inner surface of the right lung.

The *left surface* is a convex triangular area, directed mainly upwards and towards the left. It includes about one half of the free surface of the left ventricle, and the left auricular appendix. It is separated from the anterior surface by the left border; from the inferior surface by a rather sharp left inferior border, and behind it is bounded by the left pulmonary veins, and left auriculo-ventricular groove with the coronary vein imbedded therein. It presents the proximal extremities of the descending branch of the left coronary artery and great cardiac vein, the marginal and transverse branches of the same artery, and the posterior cardiac and coronary veins. *Relations*.—It is separated by pericardium from the left phrenic nerve and vessels, left pleura, and inner surface of the left lung.

The *posterior surface* (dorsal surface) is called the base in the text book descriptions. It is four sided, rather narrower above than below, is convex, vertical, and directed backwards. It is formed by the left auricle and by the portion of the right auricle which joins the two venæ cavæ behind. It is bounded below by the inferior vena cava and the coronary sinus; above by the right pulmonary artery; on the right by a fairly defined border joining the two venæ cavæ and on the left by the cardiac openings of the left pulmonary veins and great coronary vein. It presents the openings of the coronary veins (right and left) the great coronary veins and coronary sinus and the oblique vein of Marshall which runs downwards over the surface to enter the left extremity of the coronary sinus. It is only partially invested by the serous layer of the pericardium. *Relations*.—It is separated by pericardium from the bronchi, œsophagus and vagi, descending aorta, vena azygos major and thoracic duct.

The *inferior surface* (diaphragmatic surface or base) is quadrilateral, slightly convex or almost flat when the ventricles contain blood, slightly concave when they are empty and relaxed. It is directed downwards and a little backwards and towards the right and is bounded by rather sharp and well defined borders. It is formed by a small portion of the right auricle and opening of the vena cava inferior, the rest of the surface being about equally divided between the right and left ventricles. Behind the vena cava is seen a small portion of the left auricle. In addition to the inferior caval opening it presents the inferior extremities of the right (anterior) and left (posterior) interventricular grooves with the right coronary artery imbedded in the former

and the coronary sinus in the latter. Crossing it diagonally is the inferior interventricular groove with the descending branch of the anterior (or right) coronary artery and middle cardiac vein. The posterior cardiac vein runs along its posterior border. *Relations*.—It is separated by the central tendon of the diaphragm and some diaphragm muscle from the superior surface (*impressio cardiaca*) of the liver.

The apex of the pyramid is formed by the aorta, pulmonary artery, and superior vena cava, and these structures spring from the heart on a level with the upper margin of the third costosternal articulation, extending an inch and one-half ($1\frac{1}{2}$) to the left, and one (1) inch to the right of the middle line. This we may conveniently name with clinicians the upper limit of the heart.

SUPERFICIAL INDICATIONS.

The *upper limit* of the heart has just been indicated. The left half of this line will mark the position of the pulmonary and aortic valves. The *clinical apex* is indicated by a point between the fifth and sixth ribs, three and one-half ($3\frac{1}{2}$) inches to the left of the middle line.

The *anterior inferior border* is to be indicated on the chest wall by an oblique line slightly convex downwards extending from the clinical apex on the left, across and slightly upwards to a point one inch to the right of the middle line at the level of the sixth chondro-sternal articulation. Along this line the cardiac blends insensibly with hepatic dullness.

These lines being drawn, the right and left borders of the heart's anterior surface or the absolute lateral limits of the heart's dullness will be defined by convex lines joining respectively their right and left extremities. Thus on a level with the fourth chondro-sternal articulation the area of the heart's dullness extends three inches to the left and one and three-fourth ($1\frac{3}{4}$) inches to the right of the middle line.

It would seem more consistent with the above description to change some other elements in the cardiac nomenclature. For instance, the interventricular grooves are seen to be superior and inferior. The *right coronary* artery I would name *anterior*, and its branches respectively infundibular (as at present), right ventricular (now "marginal"), and inferior interventricular (now "descending"); the left coronary artery would be better named posterior, and its branches superior interventricular (now "descending"), left ventricular (now "marginal"), and auriculo-ventricular (now "transverse").

DR. WILDER said: It is very interesting to note that whenever an investigator applies modern methods to the study of the human body, he finds something lacking in the standard works. It is too easy even for learned anatomists to accept former statements without critically examining the parts over and over. I understand that the author made his preparations by means of gelatin injections. I have made some preparations in this way. I think, however, that the use of alcohol, alinjected, leaves the cavities more available for study.

I look forward to the time when there will be a comparative study of the hearts of different mammals, by means of specimens prepared in various ways. Nearly all our animals (at Cornell) have their hearts alinjected. I may not live to utilize them, but my successors will find scores of well-prepared, well-preserved hearts of many vertebrates, named ready for investigation when the right man and the right time arrive.

DR. DWIGHT said: I am unable to understand the relation of the aorta and the cava, as it exists in this drawing. They do not seem to correspond to what can be found by a series of horizontal sections through the chest.

DR. GERRISH: I think that Dr. Keiller is correct in his description, although I am not prepared to defend every position which he takes. The paper says that the right ventricle was filled with blood, and this fact may help to explain one point on which there is disagreement. I know he has been working at this matter for a long time, and it would be very strange if, with all the attention which he has given the subject, he were not substantially correct.

DR. DWIGHT said that the His model of the human heart obtained from Dr. Piersol exactly bore out his criticism of the position of the superior cava and the aorta referred to in Dr. Keiller's paper.

THE NOMENCLATURE OF NERVE CELLS.

BY DR. FRANK BAKER, PROFESSOR OF ANATOMY, MEDICAL DEPARTMENT, UNIVERSITY OF GEORGETOWN, D. C.

[Published in the *New York Medical Journal*, vol. LXIII, 1896, p. 373.]

since the discovery first adumbrated by Golgi and de-
by Cajal, Retzius, van Gehuchten, Kölliker and others,
the nervous system is composed of co-ordinated units ar-
ranged in a somewhat definite manner, attempts have been made

to find a suitable name for these units. This society has had the matter under consideration before, namely at the session at Washington, in 1894, when Prof. P. A. Fish presented a paper on the Terminology of the Nerve Cell, which was afterward published in the *Journal of Comparative Neurology*.

The following terms for the elementary unit have been proposed :

Neuron,—Waldeyer, 1891.¹

Neurone,—van Gehuchten, 1893,² citing Waldeyer and evidently considering this the French equivalent of his term.

Neurodendron or neurodendrid, Kölliker, 1893.³

Neura,—Raubert, 1894.⁴

Neurocyte,—Fish, 1894.⁵

Schäfer⁶ deprecates the use of a new term for this unit. He thinks it should merely be called a nerve-cell, which in fact, it is. This may be met with the statement that the term nerve cell has long been applied to the mutilated cell bodies that appear on our microscope slides, thus distinguishing them from their detached processes, the nerve fibres. There will, therefore, be a certain gain in lucidity if a new term is employed.

Waldeyer's term *neuron* has been objected to, 1st; because it has before been used for several other structures, and notably for the cerebro-spinal axis; 2d, because it is etymologically incorrect, the Greek term *θ νευρων*, from which it is derived, necessarily meaning an assemblage or meeting point of nerve units.

It may be noted that it would have been more accurate if those anglicizing the term had spelled it as van Gehuchten and other French authors do, *neurone*.

Kölliker's terms have never attained any currency. They are clumsy and do not lend themselves well to combination. Besides there are periods of embryonic life when the cell does not have an arborescent character, and the name would then be inapplicable.

Raubert's term, although very well in German, where it has the plural *neuren*, is not satisfactory in English, as it has the form of a Latin plural and is likely to be mistaken for such.

Fish's term is an excellent one, and to be preferred to those used before him. Still, it does not readily lend itself to combination.

It has occurred to me that in English it would be much better for us to anglicize Raubert's term and simply call the element a *neure*. This would give a short single-word term of excellent euphony and of great ease of combination. In order to illustrate this I will show how the nomenclature of the different classes of elements might be arranged by this means.

In the first place, we may divide all existing nerve cells into three categories, the first comprising those which collect sensations; the second those which distribute them to other neurones, and the third those which finally affect the organ in which force becomes manifest. The first may be called *æsthésioneures*⁷, the second *zygoneures*⁸, the third *dynamoneures*⁹.

The researches of Lenhossék upon *Lumbricus*¹⁰ and of Retzius upon *Nereis* and the mollusca¹¹ show that in their primitive condition *æsthésioneures* are not collected in ganglia, but distributed throughout the epithelium. From this original scattered condition up to the ganglionic aggregations found in the higher vertebrates there is a regular gradation, the cells sinking deeper and deeper from the surface until they are finally collected in the neural crest. The original bipolar form still persists in the lower vertebrates, the unipolar form being a later development. The same gradation may be noted in different parts of the nervous system of man. In the olfactory region and the internal ganglionic layer of the retina the scattered arrangement of cells persists; upon the auditory nerve they are bipolar, though collected in ganglioform masses; in other ganglia they are unipolar, the primitive form in the fœtus being, however, bipolar.

In view of these facts, I am led to divide *æsthésioneures* into two subclasses, the first comprising those that are scattered throughout the tissues and which I will term *sporadoneures*¹², the second those collected in ganglia, which I will term, after Minot, *ganglioneures*¹³. This latter term might replace the term ganglioblast, proposed by Lenhossék¹⁴, and *æsthesioblast*, proposed by me¹⁵.

The term *zygoneur* should replace *commissural cell*. *Zygoneures* lie mostly within the cerebro-spinal axis, some cells of the sympathetic system offering an exception. Those of the axis may be termed *axoneures*¹⁶, and of these the ones connecting closely contiguous areas, the "short path" cells of van Gehuchten¹⁷ could properly be called *brachyneures*¹⁸, others connecting distant areas the "long path" cells¹⁹, *teloneures*²⁰, for which term I am indebted to Prof. Huntington. Cells of the so-called Golgi type with short axis-cylinder processes would necessarily be brachyneures. *Zygoneures* may also be divided into those connecting the same side of the cerebro-spinal axis, those connecting

the same and those connecting with both the same and the opposite sides, and those connecting with both the same and the opposite sides. The systematic names of these would be, adapted to an etymology suggested by Van Gehuchten²¹, *homoneures*²² and *heteroneures*²³.

homoneur (for which I am indebted to Prof. Ward)

is applied to the terminal cells that produce action in organs whether muscles or glands [*myoneures*²⁵ or *adenoneures*²⁶]. The motor cells of the anterior horn of the spinal cord and many cells of the peripheral plexuses of the sympathetic are of this class.

If it is urged that this classification is physiological rather than anatomical, I would point out that anatomical relations are in each case sufficient to determine the class. *Æsthesioneures* are essentially peripheral, presenting processes free or in contact with epithelial cells; *zygoneures* are central, passing from one neurone to another; while *dynamoneures* pass from a neurone to some non-nervous element.

Within this classification other groups may be formed should they be found desirable. Van Gehuchten speaks of *cellules radiculaires*, which form the nerve roots, and *cellules des cordons* (the Strangzellen of Lenhossék), which form by their processes the columns of the cord. These might be called *rhizoneures*²⁷ and *chordoneures*²⁸.

To recapitulate, I propose the following classification and terminology:

Neural elements = *neures*, divided into—

1. Collectors, or *æsthesioneures*.
 - a. Scattered cells, or *sporadoneures*.
 - b. Cells collected in ganglia, or *ganglioneures*.
2. Associators, or *zygoneures*, comprising—
 - a. "Short path" cells, or *brachyneures*;
 - b. "Long path" cells, or *teleneures*.
3. Dischargers, or *dynamoneures*.
 - a. Cells connected with muscles, *myoneures*.
 - b. Cells connected with glands, *adenoneures*.

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⁵ Fish, P. A. The Terminology of the Nerve Cell. *Proc. Assn. Am. Anat.*, 1894.

⁶ Schäfer, E. A. The Nerve Cell Considered as the Basis of Neurology. *Brain*, pts. 61 and 62, pp. 134-169.

⁷ αἰσθησις, perception.

⁸ ζυγόν, a yoke, or bond.

⁹ δυναμις, power.

¹⁰ Lenhossék, Mich. v. Ursprung, Verlauf und Endigung der sensibeln Nervenfasern bei Lumbricus. *Archiv. f. mikr. Anat.*, 1892, xxx.

¹¹ Retzius, G. *Biologische Untersuchungen*. Neue Folge, v.

¹² σποράς, -αδός, scattered.

¹³ γαργαλιόν, a swelling under the skin.

¹⁴ Lenhossék, Mich. v. *Der feinere Bau des Nervensystems*. Berlin, 1893.

¹⁵ Baker, Frank. Recent discoveries in the nervous system. *New York Medical Journal*, June 17 and 24, 1893.

¹⁶ αξων, an axis.

¹⁷ Cellules des voies courtes.

¹⁸ βραχυς, short.

¹⁹ Cellules des voies longues.

²⁰ τηλε, far.

²¹ *Op. cit.*, pp. 209, 210.

²² ταυτο, the same.

²³ ετερος, the other.

²⁴ εκατερος, each of two.

²⁵ μυς, μυος, a muscle.

²⁶ αδην, a gland.

²⁷ ριζα, a root.

²⁸ χορδη, a string.

DR. WILDER said: It appears that the word neurocyte, although proposed by some one else, was really developed by Dr. Fish; if so, his willingness to abandon it is an encouraging sign, for it is in this way that nomenclature must be perfected. There is really very little personal adhesion to certain terms, and in that we have the advantage of the botanists and zoölogists. With them it is important to ascertain and perpetuate the prior name. We seek the most desirable terms no matter when or by whom introduced. As long ago as 1884 I proposed that the term *axis cerebrospinalis* should be replaced by the simple word *neuron*. Discovering in the Dictionnaire de Medecine of Robin et Littré, 1877, that *neuraxe* had been used in the same sense, I abandoned *neuron* in that sense and adopted *neuraxis*. I was influenced also by finding that *neuron* had been employed for a part of the eye of invertebrates. The motive was commendable, but I now think my judgment was poor, since *neuron* is certainly preferable. *Neuraxis* suggests the axis cylinder of the individual nerve fibre. I did not realize this at the time, but I now think I made the terminologic mistake of my life in too hastily abandoning a word of my own in favor of the prior *neuraxis*. If I had stuck to it, it is quite possible that *neuron* would have been generally adopted. Now *neuron* has come to be employed for the nerve cell and its processes, and the question arises whether there is any serious objection to the retention of *neuron* in both senses. When we talk about cilia we may mean either the eye-lashes or microscopic filaments, and when Dr. Baker talks about the biceps there is no misapprehension because the context shows whether it is the arm or the leg. In combination there is no difference between *neurc* and *neuron*. I see no reason why we may not just as well use the word *neuron* histologically, and combine it in whatever way Dr. Baker thinks best. What is the Latin form of

neure? We must have a Latin form for all technical terms. I may say that when I proposed *neuron* I used the Greek termination rather than the Latin, because *neurum* might suggest a liquor; for an analagous reason *cerebellum* is preferable even as an English word to the regular Anglo-paronym *cerebel* which sounds like Sarah Bell.

As to neuron and neuraxis the Society need not be afraid of hurting my feelings if neuraxis is preferred. May there not be confusion with Kölliker's *neuraxon* as a mononym for *axis cylinder*. I should like to ask the members what they will do about neurite and dendrite. They are both good terms for different processes of the nerve-cell.

DR. FISH said: It seems to me that the terminology proposed by Dr. Baker is excellent, chiefly for the reason that he makes use of words that are easily combined with other terms either as prefixes or suffixes. I had hoped that he might be able to include in this classification those cells which possess naked axis-cylinders as distinguished from the medullated axis-cylinders. Perhaps *gymnoneure* would be a good term. One of Kölliker's objections to the word neuron was, that in its original Greek it meant simply a nerve cord. Perhaps Dr. Baker's term is even more suggestive of a nerve than neuron. I hope that the terminology may come into favorable use and be extended. With regard to the terms that I suggested last year, I would say that the word *neurocyte* did not originate with me, but was first used by a Frenchman. I had an idea that we might look upon a nerve cell very much as we look upon the white blood corpuscle, or leucocyte. We include not only the cell body itself in the case of the leucocyte, but also the pseudopodia, and so in the case of the neurocyte we should include all of the processes to the uttermost extremities.

DR. DWIGHT asked: Is a classification which is so thoroughly physiological justifiable? If we look through a microscope and see a cell we cannot tell whether it is a cell with an axis-cylinder that runs a long way or not. It must be remembered that the Golgi method has changed our ideas about the nervous system, and it seems to me, therefore, that a terminology founded on physiology has no great advantage, and is liable to be overthrown.

PRACTICAL HISTOLOGY FOR LARGE CLASSES.

By C. S. MINOT, S. D., PROFESSOR OF HISTOLOGY AND
EMBRYOLOGY, HARVARD MEDICAL SCHOOL.

[This paper has not been received.]

DR. WILDER said: The conditions with us are somewhat different from Dr. Minot's, since our students are not actually in a medical school. We get much more time from them than he can, and histology and embryology are taught irrespective of their practical application. One of the wisest limitations that ever have been set to human effort in a laudable direction is that which Dr. Minot has indicated in making his embryology directly subsidiary to adult anatomy. No medical course is really long enough to properly fit students to have charge of the lives of people. They sometimes undertake things which are theoretically desirable, but practically objectionable. Dr. Minot's training of the geometrical faculty interested me very much and accords with an idea I have long had. For the study of such organs as the heart and brain, students should have a preliminary training in what is called descriptive geometry, which may enable them to gain a mental conception of relations which they have not actually seen. As many years as I have been dissecting brains, I have yet to make a section through a human brain without finding something which interests me from a purely topographic point of view. I have seen features or relations of parts that are perfectly familiar to me which for a moment I could hardly recognize.

TUBERCLE IN TROCHANTERIC FOSSA.

By DR. D. S. LAMB, PROFESSOR OF ANATOMY, MEDICAL DEPARTMENT, HOWARD UNIVERSITY, WASHINGTON, D. C.,
* PATHOLOGIST, ARMY MEDICAL MUSEUM.

Dr. Lamb showed a right femur the trochanteric fossa of which was replaced by a prominent tubercle one-third of an inch high. The left femur showed the usual fossa. Muscular markings good. Nothing was known of the subject from whom the skeleton was obtained. The anomaly seemed to be rare; was not mentioned, so far as he knew, in works on anatomy. If Dr.

Brockway's explanation was correct, that the tubercle was an exostosis, should we not expect to see the anomaly on both femurs of the same subject. In this case, at least, there was none on the other side. However, it was just possible that the bones of the skeleton were not from one individual. In this connection it was well to note that some mammals, the seals for instance, had no trochanteric fossa; in some, as the elephant, it was small. In others, as the lion, it was enormous; in the hippopotamus it was large and deep.

POLYORCHISM.

BY DR. D. S. LAMB, PROFESSOR OF ANATOMY, MEDICAL DEPARTMENT, HOWARD UNIVERSITY, WASHINGTON, D. C.,
PATHOLOGIST, ARMY MEDICAL MUSEUM.

I have here a sketch of what appears to be a case of multiple testes which lately came under my notice, in a white man, age 49, widower, father of four children, who says that he has unusually strong sexual feeling. There are three rounded bodies and apparently two epididymis in the right side of the scrotum, and a number of physicians and students who have examined him, some of them repeatedly, are satisfied that they can also distinguish three cords going up to the right abdominal ring. There is also the sensitiveness in the bodies mentioned like that shown by the testes on pressure. The condition has been known to him for many years and has never given him any trouble. Drs. Baker, Shute, Hodge and myself of this Association have examined him.

The general skepticism on this subject has led me to look up the literature, which I herewith present as briefly as possible, and in chronological order. The reported cases are more numerous than I supposed. Several writers have each listed a small number of cases, among them Arnaud¹, Bartholinus², Curling³, Rolfincius⁴, Schirurgius⁵, Sinibaldus⁶ and Schenckius⁷.

There are doubtless many cases on record which I have not been able to collate, even with the help of the titles in the Index Catalogue of the Surgeon General's Office.

The earliest writer who appears to have mentioned this anomaly is *Aristotle* (B. C. about 350), who is said by Bartholinus² to have mentioned a case of tetrorchis, or four testes, the possessor of which was childless, and the organs were small.

Passing over an interval of nearly 2,000 years, to the 16th century, we come to the great *Vesalius*⁸, than whom no more eminent anatomist has ever lived, and who states that sometimes, though rarely, we find three testes. In 1564, in a letter to Fallopius⁹, he states that sometimes in dissection and in castrating fowls, as also in some men of an entire family in Belgium, he had seen three testes. His language is as follows: "Cæterum, quemadmodum in præsentî hac tua observatione parvum quendam hic præter rationem instituis testem, huicque veluti tertium, qui revera aliquando in hominibus, uti nonnunquam etiam in Gallorum castratione, aliquando per dissectionem à me visus est, quemque aliquot in Belgica familiæ, sibi velut peculiarem vendicent, omnibus studeo adscribere, ita quoque superius ostendi, quam abs re," &c.

*Fallopius*¹⁰ himself inclined to the opinion that cases of triorchism, or three testes, were simply those in which the epididymis was loosely connected to the testis and thus gave the appearance of a third. *Willichius*¹¹ mentions triorchism in men as in the *Buteo*, which also had three testes. *Fernelius*¹² (1554) mentions a third testis as occurring in all the men of a family in Paris, just as does a sixth finger. *Montuus*¹³ knew a man with a third testis. *Hollerius*¹⁴ (1572) knew a printer's son who had three testes, and states that such a peculiarity was sometimes found in families. *Varolius*¹⁵ is quoted by some writers as reporting a case of tetrorchism, but the text seems to show only that he described the seminal vesicles under the name of the *smaller* testes, and rather took credit to himself for so designating them. After describing the course of the vasa deferentia from the testes above the pubis and down behind the bladder, he adds: "In quorum termino, (i. e., of the vasa deferentia) positi sunt alii (!) duo testes, prioribus minores, qui semini extremam absolutionem præbent, ad quos vasa deferentia eodem pacto, quo vasa spermatica ad priores, definunt."

A secular writer, *Rhodiginus*¹⁶, is quoted by several writers, especially Schenckius⁷, Arnaud¹ and Schirurgius⁵, as stating that Agathocles, tyrant of Sicily, was called by Timæus, a Greek historian, "Agathocles triorchis;" either because of his robber habits, like those of the bird, the *Buteo* (a hawk, owl or buzzard), or because of his lecherous habits, like those of the same bird; or because he really had three testes, which the bird is also said to have. He said that after the age of puberty he was very salacious; and his widow, amid sobs and sighs, remarked as follows: "non ego tibi, quid tu non præstitisti mihi," "What have I been to thee, what has thou not been to me." Rhodiginus

also says that there was an illustrious family in Bergoma, Italy, named Coglioni, many of whom had three testes, so that the family crest consisted of three black testes, whence the Italian proverb, "Coglioni da Bergoma," for monstrous or unheard of things. Rhodiginus¹⁷ also mentions Francisco Philadelphus as having three testes. Polybius¹⁸, also a Greek historian (210 to 128 B. C.), criticises Timæus severely for his statements in regard to Agathocles, and intimates that the latter was not so dark as he had been painted. The old anatomists, however, in quoting Rhodiginus seem to have understood that Timæus actually meant that the king had three testes and was very salacious. The idea of *unusual* salacity was then, as afterwards, attached to the presence of the anomaly. The remark attributed to the king's wife, standing by itself, is, of course, susceptible of many interpretations, good and bad.

Passing to the 17th century, we find a secular writer, *Thuanus*¹⁹,¹,⁵, stating that Philip, the Landgrave of Hesse, was a triorchid, and so salacious that his Counsel of Conscience was obliged to permit him to have a concubine because his wife, the Princess, could not endure his embraces.

*Forestus*²⁰ knew a young man of Antwerp who had three testes, and was very salacious. The senior *Riolanus*²¹ had seen triorchids with small testes who were very salacious and without children. *Sinibaldus*⁴ states that we find triorchids in all species in nature; especially the Buteo of the genus Accipiter, which was called by the Greeks triorchis because it had three testes; as also stated by Gaza in Aristotle; and that the bird is very salacious. *Mocchi* (Jacob), quoted by Schenckius⁷, had seen a man with three testes. *Plazzonus*²² makes the general statement as to men having three or four testes as noted by Aristotle; *Rolfincius*⁴ says that Plazzonus knew a noble Venetian who was a triorchid, but I do not find any such statement in Plazzonus. *Rolfincius*⁴ says that there are genuine and false triorchids; among the latter are those in whom the epididymis is but loosely connected to the testes, as mentioned by Fallopius; and there are those in whom a plexus of bloodvessels may simulate a testis. He had seen both the true and false. *Bartholinus*² mentions a celebrated family in Germany the males of which had three testes. *Borellus*²³ mentions two cases, father and son, in each of whom were three testes; he had also seen a third case. *DeGraaf*²⁴ makes the usual general statement as to the occasional occurrence of triorchism, and mentions a man in Delphis who had three testes and was the father of many children. *Blasius*²⁵ made a post mortem examination of an unmarried and

very salacious man, 30 years old, who had two testes in the right scrotum, one in the left, all of the same size and *with distinct bloodvessels connecting each organ with the aorta and inferior vena cava*. He gives a wood cut, which is reproduced by Monard and Terillon²⁶, showing the vascular relations. Most subsequent writers on the subject have accepted Blasius' case as genuine, however much they have doubted all the others; some, however, doubt his case. His language was: "In viro 30 Annorum, benè alias constituto, X August. 1670, inveniebamus, præter alia leviora, in latere dextro geminum testiculum, ejusdem cum sinistro magnitudinis & conformationis. Utrique vasa spermatica, similia omninò, inferebantur; originem hæc ducebant ex arteriâ aortâ and venâ cavâ, distinctis locis. Libidinosus valde defunctus dum in vivis erat fuerat, in cœlibatu alias vivens. Vide Tab. VI. Fig. VIII."

Hellwig²⁷ (J.) knew a very salacious dog which was castrated, and in which a third testis was found in the groin. He also reports the case of a man who was castrated but who continued to have sexual intercourse with emission, and infers that the man had a third testis. DeBlegny²⁸ reports a man (under the care of a surgeon named Caron,) who had four testes, two in each scrotum, near to but distinct from the other testes; each had a distinct vas deferens. The writer cautions against confusing such anomalies with tumors. Leeuwenhoek²⁹ is said by Schirurgius⁵ to state that there are four testes in *pediculis maribus*. I have examined two editions of the book without verifying the reference; and I have not been able to verify the statement itself. There are many marine pediculati. Hannacus³⁰ knew a celebrated man who had three testes. Vincet³¹ makes a general statement that there is scarcely a country in which there are not families the men of which have three testes; but they are rather infertile. He mentions a similar case, that of a Mr. Pint, in Cologne. Oribasius³² says that Welchius knew a family in Nordling, all the men of which had three testes. Scharf³³ reports a case of pentorchis, or five testes, of which three were large, the other two the size of a pigeon egg; the man was married, was very salacious and had no children. He is said to have given himself up to daily pollutions before puberty and afterwards debauched all his father's women servants. Mercklin³⁴ reports the case of a man about 25 years old with three testes of equal size in the scrotum; he had no sexual desire.

here seem to have been but few observations in the 18th century. The first is that of Lælis³⁵, who found three testes in dissecting a cadaver; he also found three in a living man who was

very salacious. His language is: "Cæterum homines offendere *Triorcheis*, qualem fuisse Agathoclem memorant, adhuc minus difficile esse, culter primo me in cadavere unico, manus deinde in Nobili Viro N. N. qui adhuc in vivis est docuerunt; quæ ferunt, hujusmodi vires, quibus nempe tertium coleum Naturæ munificentia adjecerit, pugnacissimos in Veneris castris esse, id mihi pluries Nob. Virille affirmavit, multumque supra fidem ambrosii illius roris, siquæ daretur mulierem inscendendi occasio, exjurabat profundere."

*Arnaud*¹ had studied with a young man who had three testes, who, at 14 or 15 years, was vigorous and bearded; he masturbated incessantly, and died of consumption in less than a year. Arnaud suggests that very salacious men who seem to have but two testes may possibly have a third in the abdomen. A friend of his had a very salacious dog, on which Arnaud and Garengot made a *post mortem* examination, finding two full size testes in the scrotum and a third in the abdomen, of the same size, shape and consistence as the others, situated on the left side of the bladder; its vessels were traced to quite near their origins, the remainder of their course being obscured by a mesenteric abscess. The vas deferens entered the seminal vesicle in the usual way after having described an inverted S on the side of the bladder. Garengot promised to read an account of the anomaly before the Academy of Surgery. *Sibbern*³⁶ knew a man 26 years old who had a hard, painful tumor in the left groin; it was hot and red and slipped down into the scrotum, but was pushed back into the abdomen; there remained, however, passing through the external ring a smooth mass which Sibbern made out to be a third testis of the usual size and shape, with its own epididymis and cord and the characteristic pressure sensitiveness. The other two testes were in the bottom of the scrotum, right and left; the two on the left side being distinct from each other.

The present century has furnished reports of many cases. Dr. Samuel Brown³⁷ of Lexington, Ky., says that a farmer, age 37, had what seemed to be a third testis in the right groin just above the right testis. The action of the cremaster muscle was felt when the patient retracted the testis. The two cords of that side passed through the same opening and were distinct from each other. Drs. Warfield and Marshall examined the man and agreed with Dr. Brown that there was a third testis. *Voigtel*³⁸ knew a young man in whose left scrotum were two bodies each the shape of a testis and with a separate vas deferens. *Blümener*³⁹ reports a man age 20, who had two testes, in left scrotum; the upper was the smaller, and had its own separate epididymis, cord and pres-

sure sensitiveness; this condition had existed from childhood. *Russell*⁴⁰ reports the case of a dog with two testes in his scrotum and one in the abdomen; he was very salacious. *Hauser*⁴¹ reports a man 43 years old who had a third testis on the right side with separate epididymis and vas deferens, also⁴² a man, age 55, with two testes in right scrotum, one smaller than the other, with distinct epididymis and cord. *Pranker*⁴³—a man with two testes in left scrotum, one above the other, nearly equal in size, but neither quite as large as the one on the right side; each with separate cord. *Macann*⁴⁴—a soldier, age 20, who had the usual testis on each side; above the right one, between it and the groin, was another; a separate cord distinctly traceable to each, and vas deferens easily distinguished; condition had existed from childhood, and never caused any trouble. *McElmail*⁴⁵—a soldier, age 29; a third testis had passed through the inguinal rings into the scrotum, stopping just above the one already there, of which it was about half the size; its cord and epididymis distinct, lying posterior to the other cord; and the same pressure sensitiveness as the testes. *Jacobovics*⁴⁶—a man, age 20, who had a third testis on right side, larger than the other. *Flügel*⁴⁷—a soldier, who had four testes, two on each side, each with its own cord; an additional epididymis was felt on right side; the supernumerary organs were smaller than the others. *Forster*⁴⁸—a fibrous tumor posterior to and to inner side of left testis, removed post mortem. During life it was supposed to be a third testis in the person of a Dr. Monsey. *Reade*⁴⁹ reports the case of a recruit, age 18, who had an additional testis in left scrotum, fully developed, with separate epididymis and covering; had existed since birth. *Fletcher*⁵⁰—a man, age 26, married, who had a third testis, two-thirds the size of the others, distinct from the other right testis, and which had been noticed for years. *Goodchild*⁵¹—a recruit who had a third testis on left side equally developed but entirely distinct. *Kennard*⁵²—a man, age 43, who had an additional testis on left side, of same size but distinct from the other by quite a space; apparently connected to it by the same cord; with the characteristic pressure sensitiveness; separate epididymis readily felt above upper end of each organ; he had noticed the anomaly since age of 12. *Stewart*⁵³—a man who had a swelling in right groin when three weeks old; had similar swelling in left groin one year afterwards. At 15 years of age the right was so enlarged and there seemed to be such signs of peritonitis that a hernia was suspected; the incision for removal of a testis connected with the one of same size of goosequill and about two

inches long which supported both testes. The testes in the scrotum were well developed. Two months afterwards the right additional testis was still half way between the external ring and scrotum; the left was in same relative position but gave no trouble and was thought to be also an additional testis. *Hewitt*⁵⁴—a soldier who had the usual testes *in situ*; there was a third, about one inch above the left, midway between it and external abdominal ring, and well in the scrotum. The two were distinct and movable on each other, and had the same pressure sensitiveness. Only one cord could be made out, although Dr. H. believed that he felt two vasa deferentia. The condition had existed since the man's earliest recollection and had never given him any trouble.

*Rey*⁵⁵—a soldier who had syphilitic destruction of left side of scrotum. He gives a lengthy description of the conditions in the case, which more briefly stated were as follows: During the treatment a swelling on the left side which was thought to be a hernia was found to be an additional testis, somewhat larger than a linnet's egg, and with small epididymis and vas deferens. The lower larger testis was well characterized. It was impossible to mistake the two for lobes of the same testis; they were distinct from each other but connected by a continuation of the vas deferens. The smaller one was above, in front of and a little more internal than the other. Palpation and pressure showed two testes also in the right side of the scrotum, the accessory one not so well developed as that on the left side. The anomaly would probably not have been noticed except for the ulceration which involved the dartos and tunica fibrosa. He knew that there were four bodies in his scrotum, but they had never given him any trouble. He had 15 brothers; the father and all the sons were very salacious.

*Zhdanoff*⁵⁶—a soldier, age 21, who was admitted to hospital for what was supposed to be left inguinal hernia; swelling had, however, existed since childhood, changing position, sometimes going into scrotum, at others into abdomen; was the size of a pigeon egg; sensation same as testes; separate cord could be felt. The other testis was in usual position. *Bulatoff*⁵⁷—a soldier, age 23, who was admitted to hospital with what was believed to be left inguinal hernia; swelling nearly as large as pigeon egg; had existed since earliest childhood; changed position, sometimes going down into scrotum, at others into abdomen; separate cord could be felt; sensation same as in other testes. *Vauthrin*⁵⁸ reports the case of a horse which had been castrated but retained the characters of the stallion; examination showed a swelling in

right groin, size of pullet's egg, which on pressure escaped upwards; it was removed and found to be attached to an apparently normal cord and to the naked eye had all the details of a normal testis. *Letard*⁵⁹—a colt, one year old, which was castrated but retained the characters of a stallion. When $2\frac{1}{2}$ years old Letard examined him and found the scrotum empty; but there was a swelling high up in the right groin and with cord attached. This third testis was removed; its cord showed the attached and atrophied cord of the testis which had been previously removed. *Hough*⁶⁰—a man, age 22, who had a small tumor lying against the right pubic bone; it had appeared suddenly and had never been seen before. There were two normal testes in the scrotum; pressure sensitiveness the same for all. It was pushed back into the abdomen, with instant relief. *Armstrong*⁶¹—a negro, age 22, who had two bodies in right scrotum; one was $4 \times 3\frac{1}{2}$ inches in circumference; its vas deferens was attached at base of tunica vaginalis; the tunics were not separable, were fibro-cartilaginous and enclosed two ovoid bodies, one of which was small and apparently epididymis and partly calcareous; the other larger, filled with brownish granular fluid, apparently the broken down testicle substance. The testis was removed. *Leven*⁶²—a man, who had two testes in the left scrotum; the upper had the same sensation as the lower; the condition had existed since childhood. *McGe*⁶³—a man who had a smooth, oval body in left scrotum about one-third size of normal testis, behind which it lay, below and separate from the epididymis, apparently closely connected to the vas deferens; the condition had existed since childhood; never caused any trouble. *Davis*⁶⁴—a recruit, with three testes in left side, one in right; all with the peculiar pressure sensitiveness. Three were large and well developed; the one situated high up in the scrotum was small; there seemed to be only two cords, the two large testes on left side seemed connected by subsidiary cord. *Lamb*—see at beginning of this article.

Before considering the cases cited above it will be well to present the views of some of the foremost anatomists and surgeons on the subject. It must be remembered, however, that it is always a question as to how much a writer's statements, either of fact or opinion, are based on his own personal knowledge or simply on the statements of others; much of what we find in books being but a repetition of what others have said. In this way errors as well as truths are perpetuated.

*Meckel*⁶⁵ (1812-16) states that plurality of testes is very doubtful. A man no less eminent than Meckel, *Rokitansky*⁶⁶, says

that the anomaly is very rare and that there is no sufficient proof that it occurs.

*Kocher*⁶⁷ believes that there is no confirmed case of the presence of more than two testes in the same individual. *Holmes*⁶⁸ says that there is no clear evidence of more than two having been seen in the same individual. *Agnew*⁶⁹ had twice seen the globus major so detached from the body of the epididymis as to strikingly resemble a third testis. He doubts the genuineness of the re-reported cases. *Nélaton*⁷⁰ accepts the Blasius case as the only genuine case so far known. He believes that the pressure sensitive-ness of the testis is characteristic, and should he find such tenderness in two distinct bodies in one side of the scrotum he would believe them to be two testes. *Wyeth*⁷¹ doubts the occurrence of the anomaly. *Hueter-Lossen*⁷² admits that congenital plurality of testes may, but there is no proof that it does occur. *Koenig*⁷³ says that the anomaly would seem to depend on a fault of development, but he agrees nevertheless with Kocher. *Keen* and *White*⁷⁴ agree in opinion with Agnew. *White*⁷⁵ accepts the Blasius case as the only genuine case; the others when subjected to dissection or operation proved to be encysted hydrocele, epiplocele, or some form of tumor. He says that the size, shape and even pressure sensitiveness may accord exactly with that of the testis; that even in cases of double penis there are but two testes. [This last statement is open to question as to the fact; and even if true, it would not be convincing, because the two organs are developed so independently of each other.] *Morris*⁷⁶ says that polyorchism is undoubtedly rare. *Treves*⁷⁷ says that the occurrence of supernumerary testes is rare; in the majority of cases the supposed third testis has proved to be an encysted hydrocele, (&c., &c.)

It might appear both useless and absurd for me, in the face of such forceful opinions of such eminent men, to argue in favor of occasional occurrence of this anomaly. But unless we are ready to assert that it *cannot* occur, an assertion that I do not think any anatomist, embryologist or morphologist will make, then it is worth our while to analyze the cases above recounted and estimate their value. The anomaly may simply be very rare, like some others, the occurrence of which is not in dispute. It is said that quadruple births in the human subject occur but once in 371,126 cases. It is given, therefore, to but few obstetricians in a century to witness such a birth.

The cases may be divided into:

1. Those in which we have simply the statement that the anomaly was found in some living individual, without further details. To the large number which would come under this

head I attach no importance beyond the fact that most of them were reported by men who were in the main good observers and eminent in their profession, and to that extent entitled to consideration.

2. Those in which we have some details; as the presence of a separate epididymis, of a separate vas deferens, of a separate cord, or of the pressure sensitiveness considered so characteristic of the testes.

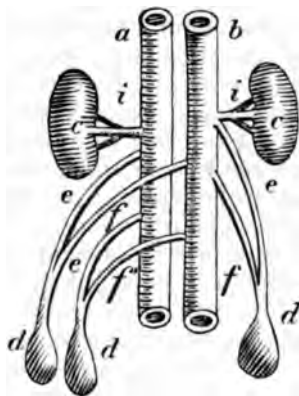
This includes the cases reported by DeBlegny, Arnaud, Sibbern, Brown, Voigtel, Blümener, Hauser, Pranker, McCann, McElmail, Flügel, Reade, Kennard, Stewart, Hewitt, Zhdanoff, Bulatoff, Hough, Armstrong, Leven, McGee, Davis and Lamb, a total of 23 reporters; some cases more satisfactory than others. Some of them are entitled to consideration at least from the professional prominence of their reporters. But of far more importance is the fact that in these cases additional cords or vasa deferentia or epididymis, or all of them, were found along with distinct bodies having the peculiar pressure sensitiveness which the great Nélaton says would convince him of the presence of multiple testes. I would ask what there could be anatomically to explain the other accessory parts except accessory testes.

3. Those in which, by reason of injury or dissection, the presence of the additional organ was revealed. Under this head are the cases reported by Vesalius, Blasius, Lealis, Rey, Vauthrin and Letard—6. These deserve some particular attention.

Vesalius was, from all accounts, a careful, conscientious and thorough anatomist. We should, therefore, be slow to assume that he mistook a hydrocele or omental hernia or some new growth for a testis. Presumably he was familiar with the gross structure of this organ, which is not like anything else in anatomy. I admit, however, that his figure of the testis is not all that could be desired, though perhaps he was not altogether responsible for its defects. He contented himself at first with stating the fact of polyorchism, but after his pupil Fallopius had expressed a doubt upon the subject Vesalius took occasion to state more fully the facts as he remembered them. His statement with regard to finding additional testes in fowls which were castrated must, however, be considered in the light of possibly mistaking the suprarenal capsule for a testis. This, as I am informed by Dr. Merriam, of the Agricultural Department, of this
 a common mistake; the resemblance between the two in
 d is quite deceptive. Dr. Merriam has dissected about
 irds; his assistant, Dr. Fisher, has dissected about 15,000;
 of these gentlemen remember ever having seen more than

two testes in the same bird. Dr. Fisher has also dissected very many reptiles without noticing any such anomaly. But Dr. Fisher tells me that he has twice seen the anomaly in the human subject, where he also found the corresponding additional cord. Dr. Hassall, of the same Department, says he has dissected many of the *Buteo*, without noticing any accessory testes. Mr. Lucas, of the National Museum, has never noticed the anomaly.

VIII



TRIORCHIS

REPRODUCED FROM BLASIUS.

The case reported by Blasius would seem to be indisputably genuine if we accept his statement concerning duplication of the supplying bloodvessels. Further detail, especially in regard to the vasa deferentia, would, of course, be very desirable.

The case reported by Lealis is stated so briefly that I am far from being convinced. So interesting and important an observation should have been presented with more detail.

The case of the soldier described by Rey is given with much detail. The sloughing of the scrotum afforded an unusual opportunity to observe the condition of the internal parts. The report carries with it a strong element of probability.

The cases of the two horses reported respectively by Vauthrin and Letard are recorded much more fully than as I have given above, and seem to show intelligent and conscientious work. Both horses showed the scars of the first castration sufficient to satisfy the second operators that a double castration had been performed in the first place. If these two and the case of the dog on which

Arnaud made a post mortem examination, be accepted as genuine, we must concede the possibility and probability of some of the reported cases in the human subject also being genuine.

Several of the writers quoted state that the anomaly was found sometimes recurring in the same family. This is not surprising if true, because it coincides with what occurs in other minor anomalies.

It is interesting to note that almost without exception the reporters state that the individual showing the anomaly was unusually salacious. This excessive salacity would seem to be in accordance with the observation that castration is attended in either sex with loss of sexual feeling. Several writers have suggested that men who have apparently but two testes and yet at the same time show excessive sexual feeling may have a third testis in the abdomen. I know that some authors hold that when the testis is retained in the human abdomen it fails to function; but if this be true I fail to understand why the testes in birds do not also fail to function. To my mind it is not a question of mere retention, but of fault in development or degeneration.

The question of children or no children in these anomalous cases does not seem to me to have weight; first, because it is well known that excessive sexual intercourse is more likely to prevent than promote conception; and secondly, because the woman herself may be sterile from causes entirely independent of the man.

Dr. Stiles, of the Agricultural Department, informs me that polyorchism is found in some of the Distomata of the class of Entozoa, and gives me the following names: *Pleorchis raillet*, 1896; this is the *Polyorchis* of Stossich, 1892, not that of Agassiz, 1862, which is a coelenterate. *P. polyorchis* and *molle*, in which are two rows of testes; each row is probably a subdivision of a single testis. *P. richardi*, in which are two groups of testes, each group being probably morphologically one testis with two vasa deferentia. *P. cygnoides*, in the young of which are two testes and two vasa deferentia, which in the adult are subdivided into two series of many separate testes connected by the two vasa deferentia. *Schistosomum hæmatobium* of man, the blood-fluke, has four or five testes connected by one vas deferens; some of these occasionally show subdivision. *S. palonicum* of ducks, in which are numerous testes.

Blasius' description and figure would seem to show the presence of two independent testes, and not simply a subdivision of one. Either condition would suggest that a division of the primitive genital ridge had taken place at a very early period. I

fail to see why this may not occur as readily as the subdivision of the embryo itself, which gives rise to homologous twins or double monsters.

The occurrence of multiple testes or multiple ovaries would seem *a priori* to be as likely or unlikely the one as the other. I have not looked up this subject. Denial or admission of either I should think would be equivalent to a denial or admission of the other.

I acknowledge herewith the courtesy of the gentlemen of the Library of the Surgeon General's Office; and especially the assistance of M^{essrs}. Israeli, Nichols and Tibbets in translation.

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A NOTE ON THE CEREBRAL FISSURATION OF THE SEAL (*Phoca vitulina*).

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The specimen was not more than one year of age, and came into my possession in November, 1895. During the manipulation incident to the process of hardening some general resemblance of the fissural pattern to that of the feline or canine type was noticed. The pia was removed and the fissures studied at an intermediate stage of the hardening before their walls had lost their pliancy.

Dr. E. C. Spitzka (1890) in a preliminary paper (*American Naturalist*, XXVI, 115-122) refutes some rather grave misrepresentations by Theodor, 1887 (*Das Gehirn des Seehundes*, Inaugural Dissertation) one of them being the existence of a so-called *Commissura Suprema* an elongated transverse mass of fibres lying dorsal to the Callosum, an artifact pure and simple. Theodor further states that "the Seals and (ordinary) Carnivora are in their cerebral organization to-day widely separated and their common origin must be sought in a remote geological period." In regard to this Spitzka states that the examination of a series of brains beginning with the mink, the fresh and salt water otters and passing through the eared to the earless seals would show about as beautiful a transition as a morphologist could well desire.

In the specimen at hand the frontal region of the brain is very much fore-shortened and gives the appearance of considerable width. On the lateral aspect the Sylvian fissure is well marked and pursues its usual dorso-caudal course. Just in front of it and extending vertically (dorso-ventrally) is another unnamed fissure which superficially seems to run into the Sylvian at its base. This vertical fissure Spitzka has taken for the Sylvian. He describes it as follows: "It is the enormous hypertrophy of this field (auditory cortical) which crowds the Sylvian into its unusual vertical, nay anticlinal position." The blunt frontal end of the cerebrum is an additional reason for making the above condition possible, but this view leaves a well marked fissure in the usual situation of the Sylvian unaccounted for. This opinion is still more difficult to accept when we come to "sound" the fissures (examine their depths). The vertical and the true Sylvian fissures meet superficially at the latero-ventral angle of the

cerebrum, and, if the sides of the Sylvian be separated, it will be seen that the vertical fissure instead of directly joining the Sylvian becomes a submerged fissure, at this point corresponding to the preopercular area of the human brain, and crops out again on the ventral surface on the front or cephalic wall of the mouth of the Sylvian. In reality the vertical is an open surface fissure in its dorsal half and overlapped by the cortex (supergyre) in its ventral half. This condition is found on both sides.

Tiedemann (*Icones cerebri simiarum et quorundam mammalium rariorum*, Hidelbergia, 1821), in a figure of the base of the seal's brain shows the ventral outcropping of a fissure in the cephalic wall at the base of the Sylvian which is none other than the terminus of the vertical. The present specimen confirms this exactly.

In the feline brain the fissure approximating most nearly to this vertical fissure of the seal would, in my opinion, be the anterior fissure; for if the frontal region of the cat's brain could be moulded by any process of growth to the relatively fore-shortened condition of the seal's brain the parts would assume very much the same relations. The *fissura postica* of the cat's brain does not seem to be represented in the seal.

The super-Sylvian and the post-Sylvian are well marked. The two are continuous with each other at the surface on both sides; but at their union two branches are given off on the left hemicerebrum and one on the right hemicerebrum. The presence of subgyres at this point makes it very difficult to get accurate soundings; and whether the union of these two fissures is anything more than superficial is, therefore, somewhat uncertain.

The lateral fissure is long and tortuous and well on the dorsal surface; its average distance from the intercerebral cleft being about one centimeter. On the left side it unites superficially with the super-Sylvian at the level of the vertical anterior fissure. On the right side the union is deeper and in advance of the anterior. The caudal termination of the lateral fissure is at the extreme end of the cerebrum and is in the shape of a T, due to the union of a small transverse fissure, possibly the lunate of the cat.

The ansate is a well developed fissure and is almost directly vertical in its course. It arises within less than a centimeter of surface caudal to the cruciate and extends ventrally to the level of the superficial confluence of the anterior and posterior. On each hemicerebrum there is a superficial super-Sylvian with the ansate, but in each there is a shallow (vadum) between them.

The diagonal of the cat is not distinctly represented in the seal, unless on account of the very much fore-shortened condition it has become confused with the ansate or cephalic portion of the super-Sylvian.

The super-orbital fissure arises from the base of the olfactory bulb, which covers its origin, and extends in an oblique ventro-caudal direction to within one-half a centimeter of the basi-Sylvian.

The olfactory is a very short but deep fissure in which the delicate olfactory crus is almost completely imbedded.

The cruciate fissure of the right side extends for a distance of a centimeter and a half on the dorso-lateral surface and has considerable depth. It also extends a centimeter and a half on the mesal surface. Very near the dorso-mesal margin a dorsal branch is given off and nearly opposite this is a ventral branch.

The left cruciate fissure extends less than one centimeter on the lateral surface, but a minor fissure connecting with it superficially makes it apparently extend over two centimeters. As with the right hemisphere a dorsal and a ventral branch are given off on the mesal surface, near the dorso-mesal margin. The cruciate continues superficially as far as the splenium with a fissure corresponding to the super-callosal. A super-callosal seems to be represented on the right side, but it does not join the cruciate.

The splenial fissure arises at the dorso-mesal margin of the hemisphere at about the level of the splenium. It is oblique in its direction (ventro-caudal) and is more vertical than horizontal. It extends well on to the ventral aspect (about one centimeter.)

In the dog and cat cerebrum the fissures are for the most part isolated and distinct; but in the seal there are numerous branches given off and rather an unusual amount of confluence of the larger fissures. The complexity is increased by the sinuous course and the presence, below the surface, of numerous subgyres or outgrowths along one wall, while the other wall overlaps and becomes more or less concave in adapting itself to this growth. This sinuosity at the depth of the fissure (much more marked than at the surface) makes an accurate sounding well nigh impossible. The obliquity of the fissures and the overlapping of one wall by the other, especially in the case of the ventral portion of the splenial, amounts to almost an operculum or poma. These conditions in many regions render the accurate determination of a fissural integer very difficult.

Underlying all there seems to be a fissural pattern not unlike that of the feline to which are added the various complexities above enumerated, but these are hardly sufficient to obscure the carnivore type.

PLATE.

REFERENCE LETTERS FOR THE FISSURES.

<i>ans.</i> —ansate.	<i>ml.</i> —medilateral.
<i>ant.</i> —anterior.	<i>Post.</i> —postica.
<i>Cal.</i> —callosum.	<i>P. Syl.</i> —post-Sylvian.
<i>Can.</i> —confinis.	<i>rh.</i> —rhinal.
<i>Cor.</i> —coronal.	<i>sc.</i> —supercallosal (?).
<i>Cr.</i> —cruciate.	<i>so.</i> —superorbital.
<i>Diag.</i> —diagonal.	<i>spl.</i> —splenial.
<i>l.</i> —lunate.	<i>Sp. Syl.</i> —super-Sylvian.
<i>lat.</i> —lateral.	<i>Syl.</i> —Sylvian.
<i>m.</i> —marginal.	

EXPLANATION OF FIGURES.

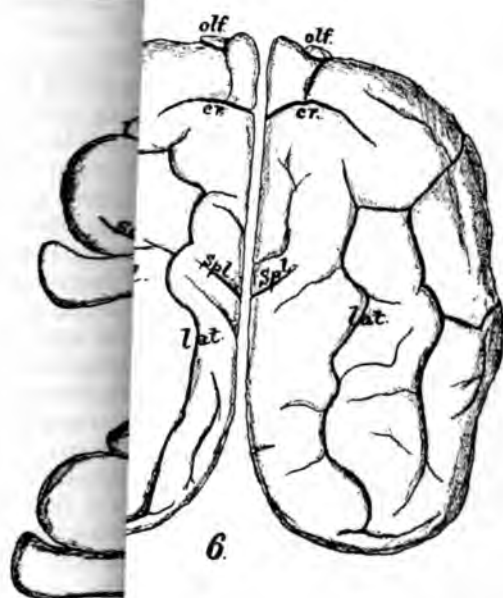
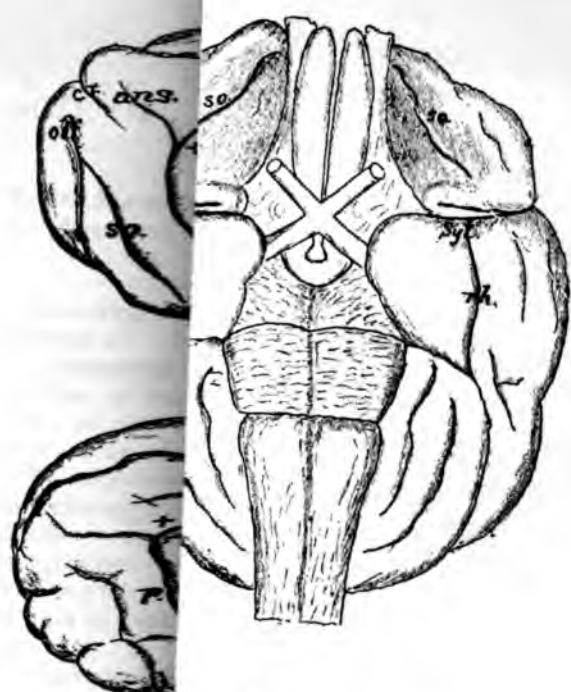
In all of the figures the important fissures are drawn with heavy lines and the minor fissures with light ones. The first four figures were photographed and enlarged drawings made. A small cross indicates a shallow depth of the fissure at that point. The fissural names are based upon those used in the Anatomical Technology (Wilder and Gage).

- Fig. 1. Lateral view of the left hemicerebrum of the seal.
- Fig. 2. Mesal view of the right hemicerebrum.
- Fig. 3. Lateral view of the right cerebrum.
- Fig. 4. Mesal view of the left hemicerebrum.
- Fig. 5. The base of the seal's brain, after Tiedemann. This figure shows the ventral outcropping of the vertical anterior (?) fissure in the cephalic wall of the Sylvian.
- Fig. 6. The dorsal aspect of the seal's brain, after Tiedemann.
- Fig. 7. Lateral aspect of the left hemicerebrum of the cat (diagrammatic).
- Fig. 8. Mesal view of the cat's right hemicerebrum (diagrammatic).
- Fig. 9. Schematic type for brain of Carnivora, after Pausch.
- Fig. 10. A cross-section of a fissure, to show the obliquity.
- Fig. 11. A diagram to show the difference in the course of a fissure at its surface and depth. The heavy lines represent the fissural walls at the surface. The dotted lines and arrows represent the deep course of the fissure.

DR. WILDER said: This subject is extremely interesting. Betz undertook to homologize human and seal brains as to their fissures. He thought he had succeeded, but I am not able to reconcile myself to his interpretations. Certain fissures of the seal brain suggest those of man, but what we need are fetal brains. I hope Dr. Fish will continue his investigations.

DR. DWIGHT: Am I right in thinking that there is a certain resemblance between the brain of the seal and that of the bear? This question was suggested to me by what Dr. Fish said at the beginning. With regard to the bear, it is very strange that the resemblance exists in a different part of the body, that is, in the pelvis of the kidney. In the seal's kidney there is, practically, no pelvis, but a system of large ducts, and the same is true of the bear's kidney.

DR. FISH thought there was a resemblance. The brain of the seal was fundamentally of the carnivore type.



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NOTE ON A UNIFORM PLAN OF DESCRIBING THE HUMAN SKULL.

BY DR. HARRISON ALLEN, PROFESSOR EMERITUS OF COMPARATIVE
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[The paper was illustrated by specimens.]

In a recent study of the human skull I attempted to frame a method of uniform description which answers a useful purpose.

Assuming that the skull presents a *norma frontalis*, a *norma basilaris*, a *norma lateralis* and a *norma verticalis*, the following order of procedure is recommended. Beginning at the *norma frontalis* and proceeding from above downward I note:

The *degree of prominence of the glabella and supraorbital ridges*, by defining an arc between nasion and ophryon, by a piece of flexible wire drawing a chord for the arc and measuring the versed sine. (In a given case it would read as follows: g. & s. o. r. = 5^{mm.}.) Next the *degree of deflection of the supraorbital margin* is recorded on a protractor (In a given case s. o. m. = 40°.)

The nasal bones yield three portions; the *frontal portion*, which is bounded above by the frontal bone; the *maxillary portion*, which lies between the frontal bone and premaxilla; the *premaxillary portion*, which lies in contact with the premaxilla. The frontal portion is measured from the angle of the nasion and the ascending process of the maxilla to the free end of the lateral margin of the nasal bone. The maxillary portion constitutes the greater part of the bone and lies entirely in contact with the ascending process of the maxilla. The premaxillary portion is the least well defined, and lies on the lateral margin of the bone a few millimeters above the free margin of the bone. The suture between the premaxilla and maxilla is never found after an early stage of development; notwithstanding the manner in which the premaxilla and the nasal bones unite in the apes, taken together with the ranges of variation in this same line, as noted in the human subject, gives one an accurate impression as to the extent of naso-premaxillary junction. The texture of the naso-premaxillary suture is distinctive. The maxillary portion of the nasal bone is divided into two parts, that which lies in contact with the frontal bone and the ethmoid bone and is outside of the nasal chamber, and that portion which lies below the one last named, and is entirely within the nasal chamber; the first part will receive the name *radix*, and the last part the name of *salient*. The degrees of angulation of both *radix* and *salient* being mea-

ured on a protractor, we have in a given case the following formulæ: f.n.4^{mm}; n.mx.10^{mm}; n.pr.2^{mm}; r.7^{mm}, 90°; s.10^{mm}, 40°.

The next region in order is the vestibule of the nasal chamber, which is accepted as the nasal aspect of the premaxilla as seen at the floor of the maxilla. When the parts of this region are as in the child, it is called *pædomorphic*, but when the pædomorphic features have not been retained the departures from this type are defined as follows: The height and elevation of the vestibule just in advance of the incisive foramina receives the name of *incisive eminence*. The degree of definition of the line extending from the sides of the anterior nasal aperture to the anterior spine receives the name of the *alveolar line*, since it defines the alveolus proximally. The *alveolus* measured from alveolar line to alveolar point of Broca (a = 15^{mm}).

Turning to the norma basilaris and describing from before backward, the hard palate is described in the terms of Broca, hyperbolic, parabolic or U-shaped. The choanæ either pædomorphic or broader at base than at apex, the diameter is to be taken (ch. pædom. diam. 22^{mm}). The pyramidal process of the palatal bone measures in length in a given case 12^{mm} (pyr. pr. = 12^{mm}).

The spinous process of the sphenoid bone, whether it separates from or unites with the tympanic bone, is to be noted; if united with this, although the line of union is posterior to that of the Gasserian fissure. In a given case (sp. pr. not in contact with tym.).

The foramen lacerum medium whether open or closed. In a given case (f. l. m. open). The petrosal part of the tympanic bone whether narrowed or broad, by being inflated on the median aspect. In a given case (p. inflated).

Passing now to the norma lateralis, it is noted that the temporal ridge is found interrupted at the stephanion; in a given case (s-interruption = 10^{mm}); and that the temporal ridge is divided into two parts, the fronto-temporal ridge and the parieto-temporal ridge; in a given case (fr. t. r. spinose: p. t. r. nil). The parieto-temporal ridge as it reaches the lambdoidal suture begins to be slightly raised above the plane of the parietal bone and is joined to the occipital bone near the asterion by a harmonic suture; or as it reaches the lambdoidal suture it has no influence in changing the serrated character of this line which extends to the asterion in the manner described in the books. In a given case we have (p. t. r. harmonic near A. 3^{mm}). The posterior margin of the frontal process of the malar bone may be produced in a conspicuous process (the marginal process) or be absent. In a given case (marg. pr. trenchant 5^{mm} high). If desirable the

height of the process could be measured by a line drawn across its base. The interruption of the temporal ridge at the stephanion, the harmonic character of the lambdoidal suture near the asterion and the large size of the marginal suture correlate to express power of the temporal muscle.

The parieto-squamosal suture at the point answering to the summit of the petrosa as it joins the side of the brain case may be marked by a mortise; thus we have ($m. = 3^{mm}$).

The term *sconce* is used to express in a general sense the region on the *norma verticalis* which lies between the parieto-temporal ridges. This diameter at the region of the bregma is recorded in a given instance as ($sc. 110^{mm}$). The lower jaw yields at the *condyloid process*, two facets, the lateral, which articulates with the zygoma, and a median facet which is more variable. It may be horizontal, inclined upward,—horizontal and inclined downward. In a given case (*condyl. pr. med. fac. horizontal*). The *coronoid process* may project at base so far forward as to conceal in whole or in part the third molar, or it may lie so far back as to permit the third molar to be seen. In a given case (*cr. pr. concealing 3m.*). The *mental foramen* may be on line with the first molar, in the interval between the premolar and the first molar, on a line with the second premolar, or on a line between the first and second premolar. In a given case (*m.f. on line of 3m.*). The *masseteric impression* ends on a line answering to the angle of the jaw or stops at a distance proximal to it; the area between these two lines constitutes the *lemurine process*. In a given instance (*lm. pr. = 3^{mm}* wide). The genial spine may be single or double. The genial crest trenchant, rudimental or absent. In a given case (*g.s. double: g.c. nil*).

In reviewing the characters which have been thus employed the glabella and supra-orbital ridge (*g. and s. o. r.*) almost universally constitute male characters of low grade; we expect in primitive man this would be better developed than in more recent man and be more apt to enter into composition of the supra-orbital margin (*s. o. m.*); no doubt is felt in accepting these important features in the descriptions of skulls. The degree of declination (*s. o. r.*) is of great importance in distinguishing between long, slender and broad, flat faces; indeed, it stands as a sign of character of face. Analysis of the nasal region needs no defence, since craniologists are of one mind, that on the whole the best characters separating crania are to be found in this region; hence, the care taken to define the relations of the naso-frontal, the maxillary, and the premaxillary portions. For the terms *radix* and *salient* I am alone responsible. The value of the vestibule would appear also to admit of no argument.

The distinction between pædomorphic and other forms, in the writer's judgment, is the best means of separating different types of the anterior nasal apertures from one another.

The value of the alveolus as defined by Broca needs no comment at this place; in like manner the shape of the hard palate. The length of the pyramidal process has been neglected by writers. I find it of value in the comparative anatomy of race. The shape of the choanæ having been defined I recognize two types, one of which is pædomorphic and is oval and the other in which the base is wider than the apex. The group last named may be subdivided by the *rectangular* form in which the basal and the lateral contours unite to form a right angle; and the *produced*, in which the basal contour is extended downward and outward beyond the line of the lateral contour. The study of the choanæ is of importance in comparative anatomy of race; the limitations have not been satisfactorily determined. The degrees of development of the spinous process of the sphenoid bone have likewise been neglected. They overlap the line of the Glaserian and the petroso-sphenoidal fissures forward to a remarkable extent and, for the most part, sex can be distinguished, being large and prominent in males, rudimental or absent in females.

The divisions of the temporal ridge into two parts, the fronto-temporal and the parieto-temporal, and an interruption between the two, is one of the best characters by which sex can be distinguished; the same is true of the conversion of the asterion process of the lambdoidal suture from a serrated to a harmonic type.

The value of the marginal process of the malar bone in distinguishing sex is conceded. The mortice in the squamoso-parietal suture and the division of the condyloid process into two facets are of secondary value.

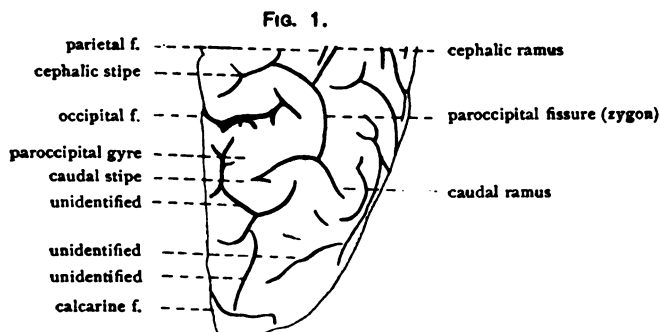
The degree of concealment of the third molar has been strangely overlooked considering the significance that this relation possesses in studies of horizontal ramus. It is evident that the degree of concealment of the third molar is in direct ratio to the reduction of size of the dentigerous portion of the bone and (all things being equal) is in evidence of the departure from the primitive type. The phylogenetic value of the so-called lemurine process of Albrecht needs to be defined. I have noted this process in the gibbon. The position of the mental foramen with respect to the sockets of the premolars and the first molar teeth is a character in osteology not to be gainsaid. In view of the results of Topinard in studying the region of the mental symphysis in primitive man it is necessary to describe accurately all structural variation at this place, hence peculiarities in the shapes of the genial spine and the genial crest are noted.

THE PAROCCIPITAL FISSURE: SHOULD IT BE RECOGNIZED AND SO DESIGNATED?

BY PROFESSOR B. G. WILDER, CORNELL UNIVERSITY.

[The paper was illustrated by specimens and photographs.]

Synopsis.—Nearly ten years ago (*Jour. Nerv. and Ment. Dis.*, June, 1886), the speaker suggested that the occipital portion of the long fissure called “intraparietal” by Turner, “interparietal” by Ecker, and “parietal” by Pansch, be regarded as a distinct fissural integer under the title *paroccipital*, referring to its constant and marked relation to the dorsal end of the occipital (parieto-occipital). The U-shaped area between the two (*pli de passage supérieure*, first annectent, etc.) he proposed to call the paroccipital gyrus. (See Figs. 1 and 2).



Dorso-caudal aspect of the right occipital lobe of a child at birth, 478: $\times 1$. It exhibits a perfect and typical paroccipital fissure, very symmetric, and completely independent of the parietal, although its cephalic ramus and the parietal overlap and approach very closely. See Reference Handbook of Medical Sciences, Vol. VIII, 1889, p. 155, fig. 4774.

The grounds for the suggestion were stated later in the “Reference Handbook of the Medical Sciences,” VIII, 155, as follows:

(1) In about half the adult hemispheres examined by the writer there are two fissures separated by an isthmus of greater or less width; (2) when the two are continuous there is almost always a vadium (shallow) at the point corresponding to the isthmus; (3) each of the two portions, whether separate or continuous, is usually deepest at or near its middle; (4) at their first appearance in the fetus they are always completely independent. The division is recognized by C. L. Dana (*New York*

Medical Record, Jan. 12, 1889, and *Jour. of Nerv. and Ment. Dis.*, March, 1894), but is thought needless by Cunningham ("Surface Anatomy of the Cerebrum," p. 219) and Kükenthal und Ziehen (*Jenaische Zeitschrift*, XXIV, 1895), and it is not sanctioned by the German Committee on Anatomic Nomenclature.

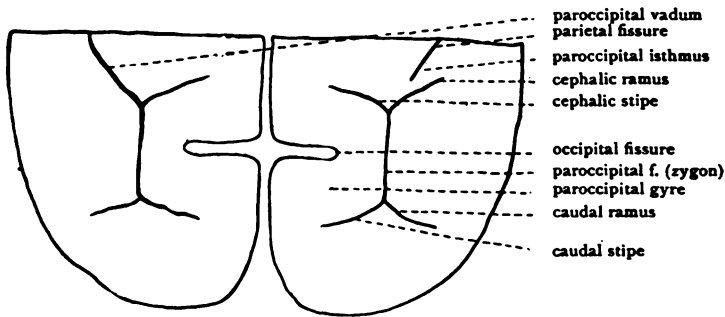


FIG. 2. DIAGRAM OF THE RIGHT AND LEFT PAROCCIPITAL FISSURES.

This is based upon the mode of development and upon the conditions observed in five out of eight moral and educated persons. The earliest and deepest portion is the zygon, a furrow opposite the dorsal outcrop of the occipital fissure. Extensions meso-cephalad and meso-caudad constitute the cephalic and caudal stipes. Similar extensions laterad, the rami. The completed fissure is a typical example of the zygal or yoked fissures. On the right either the cephalic stipe or the ramus is commonly overlapped by the caudal end of the parietal ("intraparietal"), the intervening area constituting the paroccipital isthmus. On the left a junction commonly occurs, but at that point is so frequently found a vadium or shallow place that on the diagram the continuous fissure is there narrowed a little.

The present paper was intended to embrace a review of all accessible literature, a study of the materials accumulated by the speaker in the interval, a consideration of the value in this connection of the conditions of the parts in apes and monkeys, and positive answers to the queries propounded in the title. In the time at his disposal he has been unable to accomplish these things to his satisfaction. He still thinks that on practical grounds the fissure should be recognized and called the paroccipital or the paroccipital division of a "fissural complex."

The speaker asked the cooperation of the other members of the Association and of anatomists elsewhere, in obtaining fuller statistics, and proposed to issue a circular and blank form. Photographs and drawings of the region should be taken from the dorso-caudad aspect, as if aimed directly at the outcrop of the occipital fissure. Where, as commonly on the left, the paroccipital joins the parietal, the depth at that point should be determined. Particularly desirable are the records of moral and educated persons on the one hand, and of unborn apes and monkeys on the other.

THE CEREBRAL FISSURES OF TWO PHILOSOPHERS.

BY PROFESSOR B. G. WILDER, CORNELL UNIVERSITY.

[The paper was illustrated by specimens and photographs.]

Synopsis. The men referred to are Chauncey Wright, of Cambridge, a philosophic writer and a critic and mathematician, and James Edward Oliver, Professor of Mathematics in Cornell University. The former's brain has been already partly described by Professor Dwight, (*Amer. Acad. Arts and Sciences, Proc.*, XIII, 1877, 210-215,) and the writer (*Jour. Nerv. and Ment. Dis.*, XVII, 753-754; *Amer. Neurol. Trans.*, 1890; "Ref. Handbook Med. Sciences," VIII, 158-159, IX, 108; *Jour. Comp. Neurology*, V, July, 1895, 124-125). In the last named paper Oliver's brain is also mentioned. On the present occasion one half of each cerebrum is shown, together with forty photographs of different aspects, direct and oblique, about natural size. One of the reasons for delay in publishing a fuller account of Wright's brain has been a doubt as to the number and names of the fissures, and it is hoped that aid in this respect may be gained at this meeting.

DR. DWIGHT said: I have been much interested in Dr. Wilder's paper, and it has been a great gratification to me to loan him the brain. As to the interruption of the central fissures, at the time I described it I could only find four cases in literature, but since then it has been observed several times.

DR. WILDER said: There is a difference between right and left. As was noted by Ecker (1869), Cunningham (1892) and myself (1886), the complete interruption constituting the par-occipital isthmus occurs more frequently on the right side. In eight brains of moral and educated persons, the isthmus is complete on the right in six, and on the left in only one. When all classes are included, of the twenty-six complete interruptions, twenty-one are right and only five left. Occasionally there is an isthmus on both sides or a vadium on both sides. The most common combination is of an isthmus on the right side with a vadium on the left. This condition is exhibited in the diagram (Fig. 2), and exists in Chauncey Wright, but with complications (Fig. 3). The only case of reversal of this condition known to me, *viz.*, a left isthmus with a right vadium, exists in an insane Swiss, No. 2964 of the Cornell Museum of Vertebrates. I regard the difference between the two sides of the cerebrum as notable

and worthy of further observation, but have as yet no explanation to offer.*

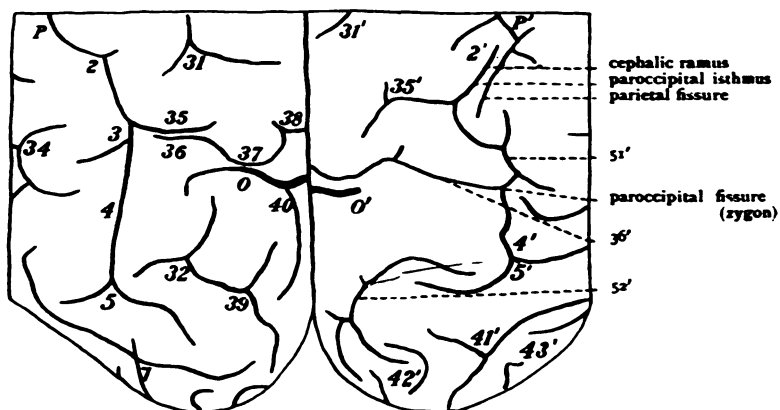


FIG. 3. THE PAROCCIPITAL FISSURES, ETC., IN THE BRAIN OF CHAUNCEY WRIGHT.

On the left the numbers correspond to those upon representations of the lateral and dorso-lateral aspects in the "Reference Handbook of the Medical Sciences:" VIII, Fig. 4779, and IX, Fig. 63.

On the right, homologous parts are designated by the same numbers, with the addition of prime. O and O', the occipital fissures, the left apparently extending farther laterad, but its depth has not been ascertained. P and P', the parietal fissures; the left joins the cephalic ramus of the paroccipital at 2, where there is a vadium. On the right the isthmus is narrow and slightly depressed. The fissure marked 36, 37, 38 and 36' is somewhat deep and may perhaps represent the preparoccipital. On both sides it is separated from the occipital by a depressed isthmus, and on the left by a scarcely visible vadium from the cephalic stipe of the paroccipital (35). On the whole this region is complex in this brain, and illustrates well the difficulties of interpreting the adult conditions in the light of development.

DR. BAKER remarked that it seemed probable that the reason why no greater progress had been made in the morphology of the cerebral convolutions was that anatomists had laid too much stress upon the details of fissural patterns, and had not sufficiently regarded the general facies produced by the thickness and modeling of the convolutions. Every naturalist knows that judgment of species depends rather upon such general considerations than upon matters of minute detail. In the dog or the domesticated pigeon, for example, almost every external organ may be made to vary according to the fancy of the breeder, but the general facies remains constant. What breeders do rapidly by artificial selection nature does slowly by natural selection. There seems to be no good reason why the brain itself should not be subject to similar laws. So long as we are ignorant of the physiological value of the different areas of the cortex we can hardly hope to advance much in comparative studies. Such

* The results of the later tabulation of the conditions in 58 adults were presented to the American Neurological Association, June 3, 1896; an abstract will appear in the *Journal of Nervous and Mental Disease*, and in the Transactions of the Association, and has been published in the *Journal of Comparative Neurology*, June, 1896, VI, 129-130.

studies are, however, of extreme value, as they give strong collateral evidence as to the functional activity of the different regions involved.

DR. WILDER said: Dr. Baker is probably right in saying that we may not determine anything physiologic, except in the most general way, from the study of fissures and gyres. Whether so or not, that is not my personal object. What I seek to determine is the fissural pattern of the normal, educated and moral white man of America for the purpose of having a standard with which to compare the abnormal brains of human beings and those of "our poor relations," the apes and the monkeys. At present we have no such standard, but I hope before I die to ascertain the human fissural pattern. I shall be quite content to leave the other more important and more fascinating questions which are connected with the physical, physiologic and psychologic correlations of the cerebrum to others like Dr. Baker, who are better capable of elucidating them.

DR. HODGE asked if the angular conformation, present in the case of a negro, was attributable to the hardening process? He had noticed that the dura was often shrunken to a far greater degree than the brain, when the brain had been hardened in the dura, producing distortion, especially when zinc was used.

DR. WILDER replied that that brain (322) was injected through the arteries, and the dura kept its original size while the brain was distended.

DR. DWIGHT said: This is an exceedingly interesting matter, but I think it is a question whether we are justified in spending our time in going into such discussion. I should like to pay one tribute to Dr. Wilder, and that is that I think he is showing a profound scientific spirit in doing this without any theory whatever; simply giving facts for others to work on. One of the drawbacks of science is that we have too many working to get facts to prove a theory with which they have started. Dr. Wilder is laboring to give us facts.

DR. ALLEN stated that he thought the subject of the study of the morphology of the brain-cortex in connection with occupation was of limited application, unless it be assumed that convolutions change after adult life has been reached. The choice of an occupation is often fortuitous. The speaker referred to General Grant. In this instance a general of the first rank would have remained undeveloped had it not been for the accident of war. In the specimens exhibited by Prof. Wilder the attention is insensibly held to the facts that one of the brains is that of a philosopher, and the other that of a mathematician; both these data are in all probability of little importance.

FOSSA CAPITIS FEMORIS, WITH OBSERVATIONS ON A TUBERCLE OCCUPYING THE TRO- CHANTERIC FOSSA.

BY DR. F. J. BROCKWAY, ASSISTANT DEMONSTRATOR OF ANATOMY,
MEDICAL DEPARTMENT, COLUMBIA COLLEGE, NEW YORK CITY.

In Schwalbe's *Arbeiten*, Vol. II, page 36, I recently read an article by Moser, "Ueber das Ligamentum teres des Hüftgelenks." One statement there made seemed to me incorrect, *vis.*, that in only about one-half the adult cases were vascular foramina to be found in the fossa capitis of the human femur. Having opportunity to investigate this matter, I find that 84 per cent. of human femora have foramina at the point of insertion of the ligamentum teres.

I do not present this paper with an exalted idea of the great importance of this little fossa; it makes no practical difference to the surgeon whether this fossa be oval or triangular, whether it has foramina in its floor or not; but if it does normally have a certain shape and a definite relation to the absence or presence of foramina, a statement of these facts is classified knowledge, and that we are told is science, here purely anatomical. I believe we often assure ourselves that we know about everything concerning some familiar point of bone or muscle or viscus, but upon studying many examples of the same, not fifteen or twenty, but several hundred, our first ideas may be greatly modified or even proven false. I have had such experience with this fossa, and cannot deprecate too strongly the modern tendency in clinical reports to draw whole sets of conclusions and establish fixed plans of treatment from perhaps a single case "upon which I have operated."

The study of the fossa capitis is a sort of sequel to that of the ligamentum teres. The functions of this ligament have been, I believe, best discussed by Moser. He disposes of them all under the following heads.—1. *Mechanical*. 2. *Protective for joint*. 3. *Protective for vessels*. 4. *Prevents congenital dislocation*. 5. *Secretes synovia*. 6. *Capillarity*. 7. (His own theory.) "*It is functionless*."

The mechanical theories have not much to do with the fossa. Welcker* was the first to conclude from comparative anatomy that the ligament had wandered in from the capsular wall. He

* Welcker; Ueber das Hüftgelenk. Zeits. f. anat. u. Entw., 1876 and 1877.

assumed the same to be true for the human species. Moser proves from his histological work on the human foetus that the ligamentum teres in man is formed *in loco* and is present in the *anlage* and never "wanders in;" there is no reason for it to do so. In certain animals we shall see there is good reason.

Gegenbaur * repeated and formulated Welcker's view, saying: "It is an apparatus lying originally outside the joint."

Sutton † defends this view and regards the ligament as the M. Pectineus of the horse and the M. Ambiens of birds which has wandered in, due to skeletal changes. Moser fully overthrows these views by embryological proof.

Paletta ‡ (1820) and § Sappey regard the ligament as a means of conduction for vessels. This view has found much favor with surgeons. Moser shows that only during foetal life and childhood do vessels constantly pass from the ligamentum teres into the head, and that the chief nourishment for the head enters by vessels coming from below through the neck, and those vessels from the ligamentum teres have only reference to the rudiment of the secondary centre of ossification of the head. Therefore the foramina found in an adult fossa have no significance. It does not follow that they recently contained bloodvessels, but without doubt they all did in early life, and the macerated bone shows foramina which may not have contained pervious vessels for years. In some cases the foramina originally there have been filled with osseous tissue; in others both fossa and foramina have become shallow or wholly disappeared.

Moser does not believe, therefore, in the vascular theory except for early life, and combats all other views above mentioned. He says: "The ligament has no function." It was originally in animals a part of the capsule, but with its reception into the joint, has lost its significance. In regard to the vessels it holds itself in the same relation as do the synovial and periosteal folds, which advance on all sides along the neck to the head, only these in most cases accomplish their purpose through life, *i. e.*, carry blood to the head while the ligamentum teres is "an atrophic structure."

The work which I have done is the examination of femora mostly of mammals, noting the presence or absence of fossæ, of foramina and their characteristic forms. In an adult, the foramina do not mean much, as they may or may not at time of

* Gegenbaur; *Lehrb. d. Anat. Bd. I, s. 298.*

† Sutton; the Lig. teres. *J. Anat. and Phys., vol. 17, 18, 19 and 20.*

‡ Paletta; *Exercitat. path.*

§ Sappey; *Traité d' anat. des.*

death have transmitted an active vessel; the idea is that their chief function, was to supply nourishment to the growing secondary centre of the head; and after its establishment or union with the shaft, the vessels atrophied, but the holes remained to a greater or less extent. In examining the animal skeletons, I have gone over well-beaten ground and have not been able to add much to that already known. Of mammals mentioned in literature which do not possess a ligamentum teres, and hence a fossa capitis, there are of the Monotremes, the *Echidna* and *Ornithorhynchus*; of the Marsupials, the Great Kangaroo; of Edentates, the Three- and Two-toed Sloth and Ant-Eater, *myrmecophaga jubata*. The Cetaceans as far as known possess the ligament and fossa. Of the Perissodactyls, it is lacking in the Tapir and Rhinoceros; of Artiodactyls, is lacking in Hippopotamus; in Proboscidea is lacking in Elephant and Hyrax; lacking in one Rodent, *Helamys caffer*, the Spring Hare of South Africa; lacking in one of the Insectivora, the Hedgehog, *Erinaceus europaeus*. It is lacking in nearly all the Pinnipedia, viz.: Seals and Walrus; present in the Carnivora and Bats, in the Lemurs and most Monkeys; absent in Orang and Gibbon; present in Gorilla and Man.

It is thus seen to be absent in a great variety of animals, animals far removed from each other, a fact apparently impossible to reconcile.

In making these observations, examinations of wet and dry specimens should be obtained of all available animals. In using dry bones, great difficulty is found in determining the presence of a fossa, especially if the impression be close to the edge of the articular surface; and such observations can not be relied upon.

Articulated skeletons are generally of but little use, as the hole for the articulating wire or rod seems always to destroy the spot most interesting to you.

I will begin my record low down in the scale and ascend to the highest type. The Reptilia have no fossa capitis. Of the Lizards I have examined 6 specimens of *Iguana tuberculata* (12 femora). The heads of the femora are smooth and compressed into a long oval. The fossa acetabuli and cotyloid notch (incisura) are present but shallow. Of Crocodilia, I have examined *Alligator mississippiensis*, 4 spec.; no fossa. Of Chelonia, Common Snapping Turtle, *Chelydra serpentina*, 5 spec. Green Turtle, *Chelonia midas*, 1 spec. Head of femur is flattened and smooth, presents no fossa; no fossa acetabuli, no incisura.

In the Reptilia, Moser thinks he has found the ground plan of the ligamentum teres, and traces its development and that of

the fossa capitis thence to Mammals and Man. He finds the reptilian hip-joint to be chiefly a ginglymus with a flat acetabulum. The long axis of the joint is nearly parallel to the body axis; the femur stands out at a right angle to the back. The axis of rotation is vertical and at the dorsal and ventral ends of the axis are accessory ligaments, one on the ventro-medial side and one on the dorso-lateral. The movements are flexion and extension. Going to the Alligator, movement is a little freer, with some ab-and adduction. With a change from the hinge joint of Reptiles to the ball and socket joint of Mammals, especially Carnivores, the appearance of the ligamentum teres is connected.

First there is adduction and movement on two axes; with adduction, a ventral part of the head hitherto lying outside the joint must enter and become articular surface, but to this part is inserted the ventral accessory ligament, *lig. access. mediale*; the point of insertion presses into the joint and drags the ligament after it. It forms a fold springing into the joint, attached to the capsule by synovial membrane. Should free motion of rotation be added, this band would lose its synovial membrane which binds it to the capsule and this is the ligamentum teres as we know it in Mammals. Finally the insertion into the head could disappear and the rest of it in the acetabulum be absorbed; thus the lack of the ligament could be explained. Changes occur at the same time in the acetabulum to accommodate the other end of the ligament; Moser proves these stages in the seal and other animals very satisfactorily.

Going next to the group of birds, we find a fossa capitis which is for the insertion of a ligament called the ligamentum teres. The head is horizontally placed at a right angle to the shaft, is rounded or even pointed internally and rests within a perforated acetabulum. There is no real neck. The great trochanter rests under the edge of the acetabulum and bears the greater part of the body weight. A sort of suspensory ligament or *lig. teres* is inserted into this head dorsally or dorso-posteriorly. Figure 1. *Psittacus erythacus*.

Of the Carinatae, I have examined the Heron, *Ardea purpurca*, *Ibis rubra*, 2 spec.; White Swan, *Cygnus am.*, 3 spec.; Goose, *Anser canad.*; the Parrot, *Psittacus erythacus*, and Cockatoo, *Cacatua galerita*, 20 spec.; of Ratitae, the Emeu, *Dromæus novæ-hollandiæ*. I suppose this ligament, although dorsally placed, may be referred to a development from the capsule by skeletal changes. Moser offers no suggestions here.

Taking up the lowest group of mammals, the Monotremata,

neither the *Echidna* nor *Ornythorhynchus* possesses a fossa capitis. I have not been able to examine a specimen of either.

Of Marsupials, I have examined the Virginia Opossum, *Didelphys virg.*, 5 spec. They possess no fossa capitis, but distinct fossa acetabuli and incisura. The heads are round and smooth, articular above and internally; have no neck. The Kangaroo Rat, *Hypsiprymnus rufescens*, 1 spec., has on each femur a slight elevation on the dorso-posterior quadrant of the head, *i. e.*, above and behind the centre, as in birds. Each impression presents two small foramina. The Phalanger, *Phalangista vulpina*, presents no fossa on left femur; on the right is a dorso-posterior impression, which may be accidental. Good fossa acetabuli and notch. Rock Wallaby, *Petrogale penicillatus*, 1 spec., presents a fossa capitis, very shallow, non-vascular and close to the articular margin in the postero-ventral quadrant.

I would add therefore the Virginia Opossum to Moser's list as having no fossa capitis.

Of Edentata, I have examined one specimen each of the Three-toed Sloth, *Bradypus tridactylus*, and Two-toed Sloth, *Choloepus didactylus*. Neither possesses a fossa capitis. The head of the femur is nearly spherical and quite smooth; good fossa acetabuli and notch. The Armadillo, *Tatusia peba*, 2 spec., has shallow fossæ, somewhat like that of a horse in shape and position (Fig. 2). It is triangular with apex rounded and directed upward and its base runs into the lower border of the neck. Each fossa contains four small foramina. There is no fossa acetabuli, but a deep incisura opposes the fossa capitis. Of the Cetacea, Whales, Manatee, etc., no lack of fossa capitis is known. I have not examined any specimen.

Of the Perissodactyla I have examined the *Tapir. amer.* and Horse. The Tapir was a young specimen with epiphyses ununited. There were distinct, shallow, triangular fossæ at the postero-ventral margin of the articular surface continuous with the under surface of the neck. The right fossa contained three large and a few small foramina; the left contained five large and a few small ones. A third trochanter was present. Moser puts this animal in both lists, saying its ligament occurs as a fold. It certainly has a good fossa, but not as deep as that of the horse, which it much resembles. The horse has a large, deep triangular fossa (Fig. 2). 3.5 cm. in vertical measurement and 1 cm. deep. It is placed below and behind the centre, with its base separated by a rough ridge from the inferior surface of the neck. Each fossa contains three or four large foramina near its apex.

Of Artiodactyla, suborder Ruminants, the Virginia Deer, *Cervus*

americanus, young spec., shows very shallow fossæ; surface of head is almost smooth. Fossæ present four or five small foramina. The Elk, *Cervus alces*, shows non-vascular, shallow, oval fossæ below and behind the centre. The Llama, *Auchenia glama* (Fig. 3), shows a deep linear fossa, directed nearly vertically and pointing nearly toward the inferior line of the neck; it is 2 cm. long and 4 mm. wide. The right contains two small foramina and the left none.

Of the suborder Pachydermata, the Peccary, *Dicotyles torquatus*, 2 spec., shows shallow, non-vascular fossæ, placed nearly vertically and approaching the inferior border of the articular surface. Angle of neck is very obtuse and high. There is a deep fossa acetabuli and a narrow, deep incisure. The Common Hog, *Sus scrofa*, shows shallow, non-vascular fossæ.

Of Proboscidea, I examined two specimens of Indian Elephant. Round heads of femur, no fossæ.

Among Rodents, the Rabbit, *Lepus cuniculus*, presents a head upon the extremity of a horizontal neck. In the centre of the head is a non-vascular fossa. *Dasyprocta agouti*, 3 spec. Youngest specimen shows a nearly central, broad, shallow, vascular fossa; epiphyses not united. The next in age was imperfect. The oldest with epiphyses united showed tiny non-vascular impressions for fossæ, as though nearly disappeared. A foramen took the place of each trochanteric fossa and opened upon the outer surface of the greater trochanter by an oblong vertical slit. The Guinea Pig, *Cavia cobaya*, 3 spec., has central, non-vascular, very shallow fossæ. The Canada Porcupine, *Erethizon dorsatus*, presents a small, deep, round fossa in the centre of the head, containing a few small foramina. The *Capromys pilorides*, 2 spec., presents very shallow, non-vascular centrally placed fossæ. The Muskrat, *Fiber zibethicus*, has a small, deep, non-vascular fossa at exact centre of head; large third trochanter, deep fossa acetabuli, but shallow incisure. Common Squirrel, *Sciurus carolinensis*, 3 spec., presents a very shallow non-vascular fossa in postero-ventral quadrant of head and third trochanter. Prairie Dog, *Cynomys ludovicianus*, 2 spec., has central non-vascular fossa, with large incisure and fossa acetabuli. The Woodchuck, *Arctomys monax*, has very shallow non-vascular fossæ and a third trochanter. All Rodents examined had fossæ.

Of Insectivora, Moser finds the Hedgehog, *Erinaceus europæus*, without a lig. teres.

Among the Pinnipedia I have examined a young specimen of the California Sea-lion, *Zalophus californianus*. The short, broad femur presents no fossa. Moser thinks the Seal and Walrus have

fossæ, which is denied by others. I have examined one specimen of *Phoca vitulina*; at the centre of the inferior edge of the articular surface is a vascular triangular fossa, whose base is continuous with the under surface of the neck, and the apex turns obliquely upward and forward into the articular surface.

Carnivora; Ursidæ. *Ursus americanus*, 2 spec., possesses small, round, deep, non-vascular fossæ just below and behind the centre of the head. Large fossa acetabuli and incisura. Raccoon, *Procyon lotor*, 2 spec., presents a deep vascular fossa on the postero-ventral quadrant of the head near the articular margin. There is a distinct notch and fossa acetabuli. The Coatimondi, *Nasua rufa*, presents oval non-vascular fossæ approaching the inferior margin of the articular surface. Mustelidæ; American Sable, *Mustela americana*, 2 spec., has distinct shallow fossæ low down near postero-inferior border; deep fossa acetabuli and incisura. Skunk, *Meleptis meleptica*, shows deep fossæ, each with a dependent groove. The *Mustela pennanti*, "Pekan" or "Fish Otter," 5 spec., shows long, oval non-vascular fossæ, ending in a distinct groove to the neck. The Mink, *Putorius vison*, shows a small fossa near centre of head. Of the Viverridæ, the Civet Cat, *Viverra civetta*, shows a shallow fossa near lower edge of articular surface. The *Paradoxurus trivirgatus*, 3 spec., shows non-vascular fossæ, without groove, behind and below centre of head. Canidæ, *Canis familiaris*, 2 spec., shows a very shallow, non-vascular fossa near lower margin of head. Red Fox, *C. vulpes*, 3 spec., shows non-vascular, shallow fossæ, with groove to postero-inferior margin of head. Felidæ; *Felis tigris* presents fossæ. *F. dom.* shows non-vascular fossæ ending in groove to postero-inferior border. *F. concolor*, Puma, 3 spec., has non-vascular fossa ending in a groove to articular margin; numerous small foramina exist in the groove. *F. onca*, the Jaguar, presents shallow fossæ. The Ocelot, *Felis pardalis*, 4 spec., shows vascular fossæ near margin.

I have not examined any of the Chiroptera.

Lemurs or Prosimiæ, *L. bruncus*, 3 spec., presents a shallow, non-vascular fossa with a groove to postero-inferior margin; good fossa acetabuli and incisura. A fresh specimen shows the lig. teres inserted into the upper part of the fossa capitis and overlying the lower part as in man (Fig. 20). *Lemur mongoz*, Mongoos, ♂, 1234 gm., young spec.; no real fossæ present, only slight non-vascular impressions for insertion of lig. teres; deep fossa acetabuli and notch. Shape of femur differs from that of *bruncus*, its upper end curving more forward.

Primates. (1.) Arctopithec, Marmoset of South America, *Hapali*

penicillata, 3 spec., shows very shallow, nearly central non-vascular fossæ.

(2.) Platyrrhini, Cebidæ; *Cebus variegatus*, *albifrons*, *monachus*, etc., 6 spec., show very shallow, non-vascular fossæ, tending to approach the inferior margin of articular surface. Spider Monkey, *Ateles belzebuth*, has shallow fossæ, almost on margin of articular surface, containing three or four large and numerous small foramina. *Lagothrix humboldti* has a shallow, small, non-vascular fossa near the margin. *Myetes fuscus*, Howling Monkey, has a very slight non-vascular fossa near centre of head.

(3.) Catarrhini, Cynocephalidæ or Baboons, 9 spec. *Cynocephalus hamadryas*; weight, 1,100 to 1,678 gm. Four specimens show large, deep fossæ near lower edge of articular surface with large and small foramina; one shows non-vascular and shallow fossæ; one shows a groove or circumvallate condition surrounding the fossa. *Cynocephalus mormon* ♂, 2,615 gm., Mandrill; lig. teres is inserted into a prominence, not a fossa, close to inner and lower edge of the epiphysis of the head. The prominence presents six or eight large foramina. Length of femur 12.5 cm. *Cynocephalus sphinx*, has deep fossæ, with foramina, approaching edge of articular surface.

Cheropithecus leucophaeus, Drill, has very shallow, indistinct fossæ, near the articular margin, presenting large foramina. *Cercopithecus callitrichus*, Green Monkey, 6 spec. Fossæ are deep, often broad, nearly horizontal and near the centre; contain one to four or five big foramina. *Cercopithecus mona* ♂, 3,001 gm. Small, deep fossa near centre, contains four or five big foramina. *Cercopithecus patas*, Red Monkey, has very shallow fossæ with one large foramen in each. *Cercocebus fuliginosus*, Sooty Mangabey, has small, oblong, deep fossa near centre of head containing one or two large and several small foramina. *Cercocebus albigena* has a deep fossa near centre with large and small vascular foramina.

Macacus nemestrinus, Pig-tailed Monkey, 2 spec., has large, deep fossæ approaching lower edge of articular surface; contains two to four big foramina. Trochanteric fossa very deep. *Macacus cynomolgus*, 8 spec. India. Fossæ vary; some are deep and some shallow, are oval and obliquely placed; all are vascular, the deep ones having two to four large foramina. *Macacus rhesus*, 84 spec. Weights, 900 to 2538 gm. Fossæ are quite characteristic and always present; they are situated in the postero-inferior quadrant, representing a long, nearly horizontal oval, with sharp ends. (Fig. 4.) Foramina are large and few and situated in the central deepest part of the fossa.

The epiphyses of all the monkey femora, especially of this one, are rarely joined to the shaft. The upper epiphysis is united before the lower, as in man. If the fossæ are shallow, the foramina are small.

Anthropomorphæ. Orang outang, *Simia satyrus*, 1 spec., young, epiphyses ununited, has perfectly smooth, round heads. At postero-inferior margin of articular surface is a little impression with vascular foramina, just intruding upon the articular surface. This would not be noticed unless especially sought for. Moser believes it is, as a rule, absent here; this is the general opinion expressed in the literature of the subject. *Gorilla gina*, 1 spec. In the postero-inferior quadrant near the centre, vascular foramina are quite numerous, but no real fossa, only a little impression to which attention is called by the foramina. A fossa is usually present here according to authority. I did not examine the Chimpanzee or Gibbon. The former is said to always have the fossa; in the latter it is lacking.

Genus Homo. It may be of interest to note the sex, nationality and age of the subjects which come to dissecting rooms. It indicates, perhaps, the relative lack of friends the different races have in New York. It will also show that a large city in the line of mixed immigration has great opportunity for averaging anatomical facts.

Statistics in different countries wholly differ as to any one point. I think New York City is especially suited to furnish a good average from the diversity of races. A dissecting room of Germany, England or Russia has subjects nearly all of one race, and statistics there would differ greatly from those obtained from many races.

Last year, 1894-'95, 213 subjects were used in the dissecting room of the Medical Department of Columbia College. Their names, nationality, sex, age, etc., are all known, and I have taken the opportunity of noting the following facts. Thirty-five per cent. of this number were females, 65 per cent. males; 86 per cent. were foreign born and negroes; only 14 per cent. were white Americans.

The distribution among races was, in order: Irish, 38 per cent.; German, 22 per cent.; Americans, white, 14 per cent.; negroes, 11 per cent. (14 male and 10 female); Italian, 9 per cent.; English, 2 per cent., and scattering 4 per cent., as 3 French, 1 Pole, 1 Arab, 1 Syrian, 1 Indian woman of British Guiana. The average age of all was 46 years, between the extremes of 17 and 96. The oldest people were Irish females.

Average age of Irish male, 49; female, 54 years.

"	"	"	German	"	40;	"	48	"
"	"	"	Italian	"	49;	"	49	"
"	"	"	U. S.	"	39;	"	33	"
"	"	"	Black	"	36;	"	41	"

The Blacks and Americans were the youngest.

A curve by decades in the males of all races shows an increase in deaths between 20th and 30th year and thence to the end of the 5th decade, then a decline. The curve for females however, is highest in the 3d decade and thence passes in a nearly straight line to the age of 80 years.

In order to determine the types and general features of the fossa capitis I have been able to examine 900 human femora, the pedigree of over 400 being known. I have easily settled the point raised by Moser in regard to the vascularity of the fossa capitis. He stated that only one-half the adult bones had foramina.

Of cases examined by me only three were under twenty years of age and none under seventeen, so practically all the 900 bones were those of adults.

I find that 148 fossæ or 16 per cent. have no foramina and 84 per cent. have foramina; 26 bones have no fossæ, are perfectly smooth; this is 2.8 per cent. In five cases there was a distinct tubercle in place of a fossa for the insertion of the lig. teres (Figs. 5 and 6). (Note case of Baboon, *Cynocephalus mormon*.)

In 5 cases there were double fossæ, two on one head (Fig. 7). In 2 cases there was a combination of a fossa and a separate tubercle on the same head. In 36 cases the foetal condition persisted, *i. e.*, a fossa and a distinct postero-inferior groove descending nearly to the margin of the articular surface and pointing toward the line passing up from the lesser trochanter to the inferior border of the neck of the femur (Fig. 8). This renders it possible to tell a right from a left femur by noting the direction of the groove. Hold the fossa facing yourself, and its groove points to the side to which it belongs. Moser has proven that this groove, which is generally present to a slight extent, is due to the foetal position of the hip joint, which is flexed and rotated out, and is present in the earliest stages of development. When the child begins to walk, the limbs are extended from their flexed position, the groove becomes shallow or disappears, and the lig. teres, now in a new position, is not able to form a new groove upon the hardening bone.

Very often a part of the fossa presents a tubercle; it is most often at the lower margin, and I do not think gives insertion to

any part of the lig. teres. Sometimes the tubercle is at the upper part of the fossa and occasionally in both places; 28 cases show the presence of a fossa and connected tubercles.

It may be well to note here the mode of attachment of the lig. teres to the average fossa (Fig. 20). The ligament is not inserted into the whole floor of the fossa, but into its upper half and upper margin. The lower part of the floor is free; the lig. teres rests upon it. The vascular foramina therefore are usually confined to a certain region, viz., the deepest part of the fossa and its upper portion. If any are in the inferior portion, it must mean that part of the ligament was originally inserted there containing vessels, which part has since disappeared.

The synovial membrane surrounding the ligament has a more extensive insertion than the ligament proper. It is inserted into the upper margin of the fossa, varying from one half to three-fourths of its whole extent. The majority of heads show this insertion by a little groove partly surrounding the fossa as the old moat surrounded a circumvallate town. The rim of the fossa is occasionally raised or tuberculated, making the groove and fossa deeper (Fig. 9).

The types of fossæ which I think are normal are three in number. If the ligamentum teres is true to its name, the shape of the fossa should be round. Dr. T. S. Sabine used to begin his description of this ligament by saying,—“ This ligament is misnamed, for firstly it is not a ligament and secondly it is not round.”

Different text-books say different things about its shape. Gray calls it an “ ovoid depression;” Morris, “ a small, rough depression;” Quain, “ a small oval depression;” Cunningham, “ a pit;” Henle, “ a round, rough depression admitting the tip of the little finger;” Heitzmann, “ a foveola;” Gegenbaur, “ the foveola capitis.” The three types of fossæ are (1.) oval, (2.) triangular, (3.) round, in this order of frequency. These three can be called typical of either set, the vascular or non-vascular. Figs. 9, 10 and 11 show the types in vascular fossæ. Figs. 12–15 inclusive show the non-vascular types.

The oval type is seen in Fig. 11, obliquely placed and vascular, and also in Figs. 12 and 13, more horizontal, smoother and non-vascular.

The triangular type is seen in Figs. 10 and 14. In the latter non-vascular form the triangle is apt to have its apex pointing inferiorly, and it shows here a tendency to a groove. The vascular type, Fig. 10, has its apex always up and base line below. The lig. teres passes over a slight groove at *a*, showing this to be the left bone.

The round types are seen in Figs. 9 and 15.

In any type the fossa may be shallow or deep. The most common type of all is the oval, Fig. 11, if vascular, or 12 or 13 if non-vascular. The next most common is the triangular, Figs. 10 or 14. The rounded type is least common. The summary of all bones in the oval type is 379, or 43 per cent.; triangular type, 310 bones, or 35 per cent.; round type, 186 bones, or 22 per cent. This rule holds with slight variation in considering the vascular and non-vascular set of bones separately.

Vascular,	Oval type,	45 per ct.	Non-vascular,	Oval type,	41 per ct.
	Triangular type,	34 per ct.		Triangular type,	36 per ct.
	Round	21 per ct.		Round	23 per ct.

There are peculiarities as to deep and shallow fossæ. Non-vascular fossæ (Figs. 12-15), are decidedly apt to be shallow in the proportion of 102 shallow to 21 deep, *i. e.*, 83 per cent. to 17 per cent. There is not this distinction in vascular fossæ, where 224 were shallow and 215 deep, about 50 per cent. for each; so in all bones, shallow fossæ are more numerous than deep ones.

There is, however, great margin in naming fossæ deep or shallow. Two men, or the same man on different days, would decide differently. The above, however, would tend to prove that shallow fossæ go with a lack of foramina; the vessels, foramina and fossa, all atrophy together.

Of vascular fossæ, the triangular are most apt to be deep. This goes with a big ligament, which is rarely round, but has three borders; 60 per cent. of them are deep. An oval fossa is apt to be shallow; it is in 57 per cent. of cases. A round fossa is apt to be shallow; it is in 61 per cent. of cases.

The characters of foramina and fossæ are not apt to be alike on both sides. In only 80 cases out of 900, 9 per cent., did I find it so. The parts to correspond were most often deep triangular fossæ.

In examining the bones, I have used the terms, large and small foramina; the large vary from 1 to 20 in a fossa, and are most often in a triangular fossa. The small foramina are a little more numerous and have a caliber of something less than 1 mm.; they do not seem to enter the cancellous tissue of the head. To determine their presence on small bones, a small hand lens was used. As a rule, shallow fossæ should present shallow and small foramina, and deep fossæ, deep foramina, but there are many exceptions in each case.

Deep fossæ are most common in negro races; three or four

big foramina in a deep fossa were characteristic. Out of 30 "black" femora, only 4 presented shallow fossæ and only 2 were non-vascular.

Among other races, I find no peculiarity. The females in general slightly outnumber the males in presenting shallow fossæ, but in non-vascular fossæ, men exceed the women, 29 to 11. All young femora have vascular fossæ, with large foramina.

The shape of the femur and that of the fossa capitis from the Indian woman of British Guiana are interesting. Note the very broad angle the neck makes with the shaft (Fig. 16), and how the oval fossa approaches the postero-inferior margin more than usual (Fig. 17).

I would call attention to the differences in the shapes of the articular surfaces on the heads of femora. In some this smooth articular surface extends some distance on the upper surface of the neck, approaching the great trochanter. Its edge is curved in and out as it descends on either side of the neck. (See Fig. 18 or Figs. 2 and 3, Horse and Llama.) This is best seen in animals where the neck of the femur is horizontal. I think that horizontality is just the point; it is a mechanical matter entirely, depending on the relation between the acetabulum and head. If the head be on the end of a horizontal neck, its whole upper surface and that of the neck, or as in case of birds even the great trochanter, may be articular. As the angle rises, only the extremity of the head bears the weight and remains articular.

Out of 900 bones, I found 4 only that may be called "pilastered" femora. 28 bones, 3 per cent, showed good "third trochanters." I did not count an exaggerated "gluteal line." Six of those with third trochanters showed also a tubercle in the digital fossa.

The "linea quadrati" I think is a myth; the quadrate tubercle alone is present in the middle of the posterior intertrochanteric line. I have never seen a distinct line below this tubercle.

The inferior cervical tubercle for the attachment of the lower arm of the ilio-femoral ligament is often very large, tuberculated or cleft; it may be as large as the small trochanter.

In going over these bones, I suddenly became aware that the trochanteric fossæ were presenting tubercles for the attachment of the Obturator externus muscle. I had never heard of such a thing, and went all over the 900 again with special reference to this fossa. I found 7 bones or .8 of 1 per cent. presenting large tubercles for the Obturator externus insertion (Figs. 18 and 19).

The tubercles may be long or pointed (Fig. 18), or flatter and



Fig. I.



Fig. III.



Fig. II.



Fig. IV.



Fig. V.



Fig. VI.



Fig. VII.



Fig. VIII.



Fig. IX.



Fig X.

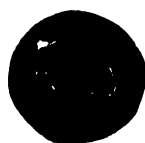


fig. XI.



fig XII.



Fig. XIII.



Fig XIV.



Fig XV.

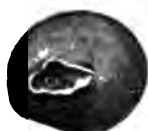


Fig XVII.



Fig. XVIII.



Fig XVI.



Fig XIX.



Fig XX.

provided with cusps like a molar tooth. They seem to give the same equivalent of space for an insertion that a fossa would.

I found a tendency to these tubercles in 131 cases, or 15 per cent., but only the above 7 were large enough to fill the whole fossa.

In regard to the meaning, I think the explanation easy and significance slight. The 7 bones here presented are not smooth, clean ones; some are small and some large. Each one presents more or less tendency to exostosis. The *lineæ asperæ* are rough; other muscles seem to have their tendons of insertion ossified, and I think in the general condition of bony outgrowth the *Obturator externus* tendon has ossified with the rest. This fossa throughout the kingdom of mammals I have seen as a foramen in the *agouti*, as very deep with thin floor in many monkeys, and finally as a tubercle in man.

DR. WILDER said: It is very modest for Dr. Brockway to say that he does not attach much importance to the observations he has made. They are important. There can hardly be any better service rendered. It is always desirable to confirm, correct or qualify the results of anatomic authorities. As to terms, if I understand rightly the report of the German committee, they are going to abandon the use of the German names in favor of the Latin. Aristotle's *proton* should then replace *Anlage*. There is one thing I wish to add in connection with Dr. Huntington's paper. He says "upper" and "lower" extremity; why not say *arm* and *leg*? Dr. Brockway spoke of the upper extremity of a bone that belonged to the lower extremity. I would like to ask Dr. Brockway if he has examined the bones of the bear, the raccoon and three others he referred to.

DR. BROCKWAY: The common American black bear and also the raccoon, I have examined. The other three I have not.

DR. DWIGHT: Several points in Dr. Brockway's paper interested me very much. With regard to the third trochanter I was glad indeed at the distinction he made in not calling an accentuated roughness a third trochanter. Some years ago I spoke of a true and a false trochanter. The true one is an animal analogy often found on very delicate bones, the latter is simply a rough prominence at the point of insertion of a muscle. The two may coëxist.

HISTORY OF THE CILIARY MUSCLE.

BY DR. FRANK BAKER, PROFESSOR OF ANATOMY, MEDICAL
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[This paper has not yet been received.]

DR. WILDER said: It is very satisfactory to hear *sclera* used instead of *sclerotic*; I noticed however that he said *chorioid* instead of *choroid*. The former was adopted in Foster's Medical Dictionary, and is etymologically correct, but the extra syllable is really needless, and will commonly be omitted, like the *u* of *dorsualis*.

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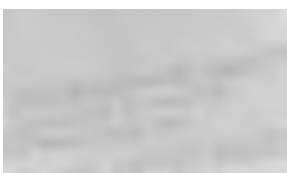
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GEOGRAPHICAL DISTRIBUTION OF MEMBERS.

New York,	24	New Jersey,	1
Pennsylvania,	17	Maryland,	1
District of Columbia,	15	West Virginia,	1
Massachusetts,	9	Iowa,	1
Ohio,	6	Michigan,	1
Connecticut,	5	Wisconsin,	1
Missouri,	4	Minnesota,	1
Canada,	3	Texas,	1
Maine,	3	Colorado,	1
Virginia,	3	Arizona,	1
U. S. Army,	2		
Illinois,	2	England,	3
Louisiana,	2	Ireland,	1
New Hampshire,	1	Scotland,	1

Total: 111—106 active, 5 honorary.



PROCEEDINGS
OF THE
NINTH ANNUAL SESSION
OF THE
Association
of
American Anatomists,

Held in Washington, May 4-6, 1897.

TO WHICH IS APPENDED A
LIST OF MEMBERS.



WASHINGTON, D. C.
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1897.

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PROCEEDINGS OF THE NINTH ANNUAL SESSION.

The ninth annual session of the Association was held in the Columbian University Scientific School, corner Fifteenth and H streets, N. W., Washington, D. C., Tuesday to Thursday, May 4 to 6, 1897, in conjunction with the other societies comprising the Congress of American Physicians and Surgeons.

Dr. Frank Baker, President of the Association, presided at the several meetings. The following members were present at some time during the session: Baker, Bevan, Blake, Bosher, Brown-ing, Carr, Dawbarn, Gerrish, Gill, Hamann, Hewson, Hodge, Hunt, Huntington, Hutchinson, Kemp, Lamb, Leidy, Mears, Miller, Mixter, Moran, Parkhill, Reisinger, Roberts, Shepherd, West and Wilder—28 in all. This includes all the officers and members of committees except Drs. Allen and Shute who were ill, and Dr. Dwight who was also unable to be present.

TUESDAY, MAY 4TH.

The Association was called to order by the President, who delivered an address.

Dr. D. S. Lamb, Secretary and Treasurer, submitted his report for the period which had elapsed since the last session, December 27 and 28, 1895. Report accepted.

The following are extracts:

"No meeting was held in December, 1896, in view of the fact that this Association is a member of this Congress of American Physicians and Surgeons which meets in this city in May, every third year. The Executive Committee believes that if we should meet both in December and the following May, the short interval between the meetings would imperil the success of the May meeting; at the same time regretting that by postponing the December meeting we lose the opportunity of attending the sessions of the Society of American Naturalists and the affiliated

societies. This is the second time this postponement has occurred, and in the nature of things seems inevitable every third year.

"Since the last meeting three members have died. Sir George Murray Humphry, an honorary member, Professor of Surgery and late Professor of Anatomy in the University of Cambridge, England, died September 24, 1896. He is perhaps best known as the author of a classic work on 'The Skeleton.' Dr. Charles Heitzmann, of New York City, at one time Lecturer on Morbid Anatomy in the University of Vienna, and who afterwards conducted a Histologic and Pathologic Laboratory in New York City, author of a work on Anatomy, having occasion to go to Europe for his health, resigned September 16, 1896. Sometime afterwards I saw a notice of his death while abroad; the exact date I cannot give. Prof. Edward Drinker Cope, Professor of Vertebrate Palæontology in the University of Pennsylvania, and author of many works on American Palæontology, died in Philadelphia, April 12, 1897.

"The financial exhibit is as follows:

On hand at last report,	\$128.07	
Receipts from dues, &c., 1895-6,	\$233.94	
1896-7,	120.00	353.94
		<hr/>
Total,		\$482.01
Expenditures for Printing and Stationery, . .	\$213.63	
Postage and Telegrams, . .	44.10	
Typewriting and Copying, . .	16.95	
Stenographer,	50.00	
Engraving,	8.25	
Expressage,	1.70	
International Directory, . .	2.09	\$336.72
		<hr/>
On hand May 1, 1897,		\$145.29

"There are 21 members in arrears: 5 for *one* year, 11 for *two* years and 5 for *three* years; the latter will be dropped from the roll at the end of this session unless the dues are paid before that time. Amount in arrears, \$84.00.

"The gentleman who reported the discussions of the last session rendered a bill of \$75.00 to which I took exception and referred the matter to the other members of the Executive Committee, who agreed with me that \$50.00 was a fair compensation, and this amount was accepted by the gentleman. As, however, some of the members whose remarks were reported were dissatis-

fied with the report, I have thought best not to consider the question of stenographer for this session, and shall need to rely upon the members themselves to make notes of their remarks.

"Another reason for not employing a stenographer at this session is the expense. It would hardly be less than \$50.00, and even at that would hardly be satisfactory, because his estimate of expense does not include a report of remarks made in lieu of written papers; and as a consequence we may have in our Proceedings a printed discussion upon a subject accompanied by the anomaly of the entire absence of the article itself on which the discussion is based. I am satisfied that to report our work in full would cost not less than \$75.00. If we were financially able to meet such expense I would favor it.

"I call the attention of the members to the fact that we have about 100 active members, which means \$200.00 in dues per year, if all pay. At the most we probably collect about \$175.00. Thus far for the current year I have collected \$120.00 and have altogether in hand nearly \$150.00, with the prospect of collecting about \$50.00 more, or a probable total of \$200.00 to meet the expenses of the current year. We have however this year, if we follow our custom, to provide for two meetings—this and another in December. Basing the calculation on the expenses of previous meetings, I believe that it will require about \$425.00 for the two meetings. Of this amount it is likely that \$150.00 or \$175.00 will not need to be paid until 1898, and can be paid out of the receipts of that year, leaving about \$250.00, however, to be met before the first of next January; and a deficit, therefore, of about \$50.00 to be assumed by your Treasurer unless he chooses to let the accounts stand open. It is a question, I think, of a special assessment or increase in yearly dues. An assessment of \$1.00 per member, which would realize about \$80.00 in all, would probably meet the emergency, and I believe will be necessary this year or next to meet current expenses. I have considered it my duty to bring this matter to the attention of the entire Association and not simply consult the other members of the Executive Committee."

The President appointed Drs. Gerrish and Wilder a committee to audit the Treasurer's accounts.

The Executive Committee reported favorably on the following applications for membership: Drs. Blair, Blake, Flavin, Miller, Moore and Reisinger and Mr. Ward, all of whom were elected. (See list of members.)

Dr. Lamb, from the Committee on Anatomical Peculiarities of

the Negro, reported a "List of Items" and "Letter of Instructions" to accompany the same. Dr. Wilder suggested several changes in the terminology, which were accepted by Dr. Lamb for the Committee. On motion of Dr. Huntington, the Association ordered that copies of the report should be printed and distributed among the members for their information and criticism, along with the statement that the *terminology* should not be considered as necessarily being that which the Association might ultimately recommend.*

On motion of Dr. Huntington, the annual dues were increased to three dollars; the increase to begin with the year 1897-8.

There was no report from the Committee on the Table at Naples, the Chairman, Dr. Allen, being ill.

Dr. Huntington of the Medical Department of Columbia University, New York City, then made remarks on "Corrosion Anatomy; technique and mass." Illustrated by the material and specimens. The subject was discussed by Drs. Wilder and Dawbarn.

Dr. Lamb of the Army Medical Museum, Washington, showed the following specimens and made remarks on the same: Fissured sternum, and two specimens of sterna of young children; an extra carpal bone; bilateral bony ankylosis of jaw; and a penis showing exaggerated papillæ on corona. Discussed by Drs. Wilder, Dawbarn, Gill, Baker and Huntington.

A paper by Dr. B. B. Stroud of Cornell University on "Comparative anatomy of cerebellum" was, in Dr. Stroud's absence, read by Dr. Wilder. It was illustrated by photographs and charts. Discussed by Drs. Gill, Baker, Huntington and Wilder.

The Association then adjourned.

At 2 P. M. the Congress held its first meeting.

In the evening a subscription dinner was given at the Arlington Hotel.

WEDNESDAY, MAY 5TH.

Meeting called to order about 9.15 A. M. by the President.

Dr. Gerrish was nominated as a member of the Executive

* Copies of the report and an explanatory circular were distributed as ordered.

Committee to fill the vacancy made by the retirement, under the Constitution, of Dr. Gill. On motion the rules were suspended, and a unanimous ballot was cast for Dr. Gerrish.

The Secretary stated that after the adjournment the previous day there was a consultation of several members, and it was thought appropriate to send to Dr. Allen, who had just undergone an operation for appendicitis, a telegram conveying the sympathy and good wishes of the Association. The Secretary had sent the telegram. On motion of Dr. Wilder, this action was approved.

Dr. Wilder of Cornell University made remarks on "The definitive encephalic segments and their designation." Illustrated by photographs and charts. Discussed by Drs. Gill, Gerrish, Carr, Baker and Huntington. In connection with this subject Dr. J. A. Blake showed photographs of a *brain with double precommissure*.

Dr. Woods Hutchinson of the University of Buffalo read a paper on "A possible morphologic basis for diseases of the lungs." Discussed by Drs. Huntington and Baker.

A paper by Dr. Stroud, on "Brain preservation," was read by title.

Dr. Huntington made remarks on "Ventral version of secondary fore-brain." Illustrated by photographs. Discussed by Dr. Wilder.

Dr. Wm. Browning of Long Island College Hospital, Brooklyn, read a paper on "Examination of spinal efferents for the cerebrospinal fluid." Discussed by Drs. Wilder and Baker.

The meeting then adjourned.

At 2 P. M. the second meeting of the Congress was held.

At 5 P. M. the statue of Prof. Dr. Samuel D. Gross, in the Smithsonian Park and near the Army Medical Museum, was unveiled with appropriate ceremonies.

At 8.15 P. M. the President of the Congress, Prof. Dr. Wm. H. Welch, of Johns Hopkins University, Baltimore, delivered the Presidential address at the Columbia Theater; and at 9.30 P. M. held a reception at the Arlington Hotel.

THURSDAY, MAY 6TH.

The Association reassembled about 9 A. M.

The Executive Committee, through the Secretary, reported a recommendation that the next meeting of the Association should be held at Cornell University, in December, 1897, in conjunction with the Society of American Naturalists and the other affiliated societies. On motion, the Association adopted the report.

The President called attention to the fact that inasmuch as the Congress met every three years, the election for delegate to its Executive Committee every two years seemed to cause some confusion. After some discussion, Dr. Hewson moved that hereafter the election for delegate occur every *three* years, and this was adopted.

Dr. Wilder from the Committee on Anatomic Nomenclature, reported progress. Report accepted.

Dr. Gerrish from the Committee on auditing the Treasurer's accounts, reported the accounts correct.

Dr. Huntington made remarks on "The cerebral convolutions of two brains from natives of British Guiana." Illustrated by casts and photographs. Discussed by Drs. Baker and Wilder.

Dr. F. J. Shepherd of McGill University, Montreal, showed a specimen of double internal cuneiform bone of right foot of a white man; and photographs of hands and feet of a girl, age 17, showing multiple digits.

Dr. W. P. Carr of Columbian University, Washington, showed some anatomical models on a large scale illustrating the circulation of the blood through the heart, the formation of a blood-vessel, and the corona radiata. Discussed by Drs. Wilder, Huntington and Shepherd.

Dr. J. A. Blake of Columbia College, New York read a "Contribution to the topographic anatomy of the mediastinum and superior thoracic aperture." Illustrated by casts. Discussed by Drs. Baker, Wilder and Huntington.

Dr. Addinell Hewson, of Jefferson College, Philadelphia, showed the forms of record used in the dissecting rooms of the

College, Philadelphia, Pa., and made remarks thereon. Discussed by Drs. Baker, Huntington, Reisinger and Wilder.

Dr. C. A. Hamann of Western Reserve University, Cleveland showed specimens of congenital malformation of the extremities. Discussed by Drs. Huntington and Geo. T. Kemp.

The Association then adjourned *sine die*.

After the adjournment, at the suggestion of Dr. Kemp, Dr. G. C. Huber of the University of Michigan exhibited slides showing the terminal endings of the nerves in the epithelium of the urinary bladder and the sensory nerve endings of muscle.

At 2 P. M. the third and last meeting of the Congress was held.

In the evening a complimentary "smoker" was given to the members of the Congress by the Cosmos Club.

CONSTITUTION.

SECTION 1. The name of the society shall be the "Association of American Anatomists."

SEC. 2. The Association shall have for its object the advancement of the anatomical sciences.

SEC. 3. The officers of the Association shall consist of a President, two Vice Presidents and a Secretary, who shall also act as Treasurer.

SEC. 4. The officers shall be elected by ballot every two years.

SEC. 5. The management of the affairs of the Association shall be delegated to an Executive Committee, consisting of its President, Secretary and three other members.

SEC. 6. One member of the Executive Committee, shall be elected annually.

SEC. 7. The Association shall meet annually, the time and place to be determined by the Executive Committee.

SEC. 8. Candidates shall be proposed in writing to the Executive Committee by a member. Each proposal shall be made at or before the first session of any regular meeting of the Association. The proposal shall state the official position or occupation of the candidate and the character of his investigations. The election shall take place by ballot in open meeting, a two-thirds vote being necessary. Honorary members may be elected from those, not Americans, who have distinguished themselves in anatomical research.

SEC. 9. The annual dues shall be three dollars. A member in arrears for dues for two years shall be dropped by the Secretary at the next succeeding meeting of the Association, but may be restored on payment of arrears, at the discretion of the Executive Committee.

SEC. 10. The rulings of the Chairman shall be in accordance with "Robert's Rules of Order."

SEC. 11. Five members shall constitute a quorum for the transaction of business.

OFFICERS FOR THE YEAR 1896-97.

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 DR. B. G. WILDER, of Ithaca, N. Y., - - - - First Vice President.
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 PHYSICIANS AND SURGEONS.**

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ALTERNATE.

DR. D. K. SHUTE, of Washington, D. C.

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 DR. D. K. SHUTE, of Washington, D. C.

MEMBERS OF SMITHSONIAN COMMITTEE ON THE TABLE AT NAPLES.

DR. HARRISON ALLEN, of Philadelphia, Pa.
 DR. GEO. S. HUNTINGTON, of New York City.

**ADDRESS BY THE PRESIDENT, DR. FRANK BAKER
OF WASHINGTON, D. C.**

[The manuscript of the address has not been received.]

CORROSION ANATOMY, TECHNIQUE AND MASS.

Illustrated by Specimens and Diagrams.

DR. G. S. HUNTINGTON OF NEW YORK CITY.

Corrosion has long occupied a somewhat peculiar position among methods of anatomical demonstration. As Hyrtl has shown, corroded preparations existed in the museum of Ruysch, and since that time corrosion has been practiced to a greater or less extent by many prominent investigators. It is scarcely possible to overestimate the value of demonstrations which the method yields. Many problems of vascular supply, especially of the viscera, the arrangement and distribution of ducts and canals, cannot be elucidated by any other means. Notwithstanding the obvious advantages of corrosion as an aid in anatomical investigation, the method has not received the attention which its merit warrants. The reason for this neglect must be sought primarily in certain difficulties inherent in the method itself. Having had occasion to practice corrosion somewhat extensively during the past six years, I have thought it worth while to communicate some of the results of our experience to the Association at this meeting, and I may deal with the matter under the following headings:

I. MASS.—The selection of the proper injection mass is, of course, the element most important to the success of the method.

It is curious to note that the secrecy with which Ruysch surrounded his method of preparing corrosions seems to have been imitated to a greater or less extent by his successors. It is a matter of regret that the information which Hyrtl gives on the composition of the mass in his large work on "Corrosion-

Anatomie" is so unsatisfactory. Personally I look back on much time and material expended in fruitless attempts at following his instructions. In spite of the utmost care, we have found it impossible to obtain even moderately successful permanent corrosions with the mass recommended by him, and we were obliged to experiment extensively before obtaining the composition which we now use, and which has given us uniformly good results. In developing this mass the following essential requirements have been kept in view:

1. The mass must fuse at a comparatively low temperature (water bath).

2. After hardening, the mass should be brittle rather than plastic. Masses which on fracture show a crystalline surface are in general to be preferred. It is absolutely necessary to have a mass which will withstand, without softening, the high temperatures of our summer months.

It is very easy, working with a soft mass, to obtain brilliant preparations, which will at first preserve their shape and relations, but which will wilt and droop out of all resemblance to the original during the first summer. Corrosion preparations which are to be permanent must possess sufficient rigidity and resistance to summer temperature.

3. The mass should take color readily and harden uniformly without cracking and splitting.

4. The rapidity of hardening is a point of some importance to the beauty of the preparations, especially if heavy suspended coloring material is used. If the mass hardens too slowly and if the vessels are large, the suspended coloring matter may sink to the lowest point of the cast, and the preparation will appear stratified and not uniformly colored.

The basis of a mass fulfilling the above requirements is a paraffin product called "ozokerit." It occurs in its natural crude state in petroleum regions, mixed with considerable oil, as a yellow, cheesy "mineral wax." This crude material can be freed from the admixture of oil, and the refined product is known in the trade as "white ozokerit." This paraffin is characterized by its toughness, and by the fact that even in the form of long and slender rods it retains shape and direction without bending or warping. My attention was called to this substance by finding that it is generally employed for the manufacture of "adaman-tine" dinner candles, which are designed not to bend or twist when moderately warmed.

For general work we have combined this material with other ingredients in the following proportions:

Ozokerit,	3 parts (by weight).
Paraffin (45°–50° C.), . . .	2 parts (by weight).
White Wax,	1 " " "
Rosin,	$\frac{1}{2}$ " " "
Venice turpentine about two drachms to a quart of mass.	

This combination gives a freely flowing mass, satisfactory for all ordinary purposes, such as lungs, liver, placenta, etc.

When very large vessels are to be injected, as the aorta or trachea of large ruminants, it is desirable to increase the proportion of ozokerit to four or five parts.

The addition of a small amount of stearin to the above mass is also of advantage for the injection of large vessels or cavities. For very delicate injections the mass may be made softer and more fluid by increasing the proportion of wax. In general, however, this is not desirable, as the resulting preparations cannot resist summer temperatures.

Preparation of Mass.—The ozokerit, paraffin and wax are melted together over the water bath. When entirely fluid the Venice turpentine and the finely powdered rosin are added—a portion of the rosin will slowly dissolve in the melted paraffin, the residue remaining at the bottom of the vessel. Masses which have been repeatedly heated take up additional rosin.

Coloring of Mass.—The mass can be colored with dry, finely powdered or precipitated coloring matter, such as English vermilion, cobalt or ultramarine blue, Prussian blue, chrome green and chrome yellow, purple lake, rose madder, etc. I have, however, found it more advantageous to employ the oil colors put up in tubes. The Masury colors have given the best results. They offer a large variety of shades, and incorporate readily and completely with the mass, producing a brilliant and uniform coloring.

The coloring matter should be added to the melted mass slowly, in small quantities and under constant stirring. Tests should be made from time to time, by allowing a few drops of the mass to fall into cold water, so as to obtain the color of the hardened mass.

To obtain *white* mass, it is only necessary to melt the ozokerit, paraffin and wax in the proportions indicated, without the addition of the Venice turpentine and rosin. It is much better, however, to retain the last named ingredients, which add a faint, yellowish tinge to the mass, but which at the same time considerably increase the rigidity of the preparations.

II.—INJECTION.—*Syringe and Canulæ.*—The ordinary hand

syringe is best adapted to corrosion injection. Great care is necessary to prevent the leather piston of the syringe from hardening by the heat of the injection mass. Frequent applications of vaseline will help to preserve the leather. We have of late years used a syringe with metal piston, made by W. Katsch, of Munich, for all warm injections, and have found the same well adapted for the purpose.

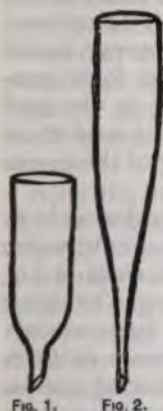


FIG. 1.

FIG. 2.

The canulae are best made out of glass tubing, as they can be left in place during the process of corrosion. A practical point in making the canulae deserves notice. The tubing should narrow abruptly to the caliber of the point, and the narrow portion should not be longer than is required for insertion and ligature. Fig. 1 shows the shape of the canulae. If the tubing is drawn out gradually (Fig. 2), the injection mass is apt to cool and harden in passing through the long, narrow portion, and the injection will not be successful. All precautions have to be taken to avoid blocking the injection by hardening of the mass at any point before the process is finished. Before beginning the injection, the syringe and canulae should be heated in warm water.

In preparing an organ for injection the blood should be removed as far as possible from the vessels. This cannot be done by washing out, as the fluid used will remain in the smaller vessels and interfere with the penetration of the mass. Careful "milking" is perhaps the best method of emptying the veins. Clots in the larger vessels must be removed before injection. For many viscera, especially if fine injections are desired, it is better to make the injections with the object floated in warm water. This is especially desirable when the organ to be injected is somewhat flaccid and soft, as pancreas and spleen, and would tend to flatten if not supported by being floated. If the entire organ is placed in warm water for fifteen or twenty minutes before injection the smaller vessels will be filled more readily.

If a number of structures are to be injected in one viscus we have found it of advantage to inject the duct first, then the arteries and lastly the veins. If the veins are injected first they will frequently become so much distended that they interfere by pressure with the complete injection of the other canals.

When once begun the injection must be made continuously without interruption. It is well to employ a syringe of sufficient capacity to take the entire amount of mass desired for any one

injection. The time required for removing and refilling the syringe will frequently be enough to allow the mass to harden in the canula, thus interfering with the further injection.

The injection must be made gently, as the heat of the mass is apt to weaken the walls of the vessels somewhat, and extravasations will result if undue force is employed.

In every case the organ must be injected in the vessel (glass) in which the corrosion is to take place. The object must not be touched or moved in any way after the injection is completed. The canulæ are left in place, both because their removal would disturb the organ, and because they subsequently form convenient handles for turning the corroded specimen in the acid bath and during the other manipulations. The vessel used must be sufficiently deep to permit the complete covering of the organ when the acid is added.

If the organ has been injected in warm water, it is desirable to cool the mass after injection by allowing a stream of cold water to run through the vessel, taking care that the current is not strong enough to injure the injection or cause the organ to strike against the sides of the vessel. Especially when large vessels are injected, the rapid cooling will give the cast a more uniform coloring. If it is allowed to cool gradually, the coloring matter is apt to settle to the lowest point in the cast of larger vessels or cavities.

III.—CORROSION.—Any water remaining in the vessel after the injection has been cooled should be removed by siphon.

The best acid for corrosion is strong (fuming) commercial hydrochloric acid. This should be gently poured into the dish containing the injected organ until the same is entirely covered. In the great majority of cases the injected object will float at first in the acid, which has a high specific gravity. It is well to cover the dish with a plate, so as to confine the acid vapors. The entire process of corrosion should be conducted either out of doors or under a properly constructed chemical hood, as the hydrochloric acid vapors will speedily destroy all iron and steel objects in the laboratory. After corrosion has been completed, a portion of the acid can be drawn off with the siphon and used over again. As long as the acid *fumes*, it is sufficiently strong for corrosion. Acid which no longer fumes should be thrown away. Many organs

(as liver) will not corrode in weak acid, which, on the contrary, hardens them.

The length of time required for corrosion will, of course, vary with the size and character of the injected object. Ordinarily two or four days to a week suffice.

Corrosion is usually complete when the surface of the object appears of a soft grumous and pasty consistency.

The remnants of the corroded tissues are to be washed away with a gentle stream of cold water, continued until the entire cast appears clean.

After drying, it is well to cover the cast with a fine coating of varnish, which will increase its strength. As turpentine varnishes would soften the wax and paraffin, an alcoholic solution of shellac must be used (known in the trade as "French varnish"). I have found that this is best applied as a spray. We have used a compressed air apparatus and one of the small atomizers which are made for spraying the throat. If the varnish is thick it is well to dilute the same with alcohol, so as to pass readily through the atomizer.

After the varnishing is finished the object can be mounted in various ways. We have found it advisable to mount the majority of our corrosions on flat disks of wood (painted black or white) or squares of plate glass (when it is desirable to see both sides of the preparation).

Corrosions which are mounted on metal stands or suspended, suffer sooner or later from unavoidable jars and knocks. They are in addition much more liable to become bent and distorted during the hot term. But if they are supported by allowing a considerable portion of the surface to rest on the mounting disk or plate they retain their shape well and form permanent museum preparations of great value and beauty.

DR. DAWBARN, in making some remarks on this paper, asked as to some means of causing the peritoneal surfaces to adhere with promptitude and firmness and without stitches; he explained that he had long and fruitlessly worked on this problem, trying perhaps fifty different adhesive mixtures, and later sending to Japan and procuring through the American Consul at Yokohama a sample of Japanese *birdlime*, which proved as sticky as anything he ever handled, and was made even more so by heating it; but, like everything else he had used, it would not cause two smooth moist surfaces to adhere firmly until nature could glue them together permanently by fibrin. The investigation was very important in regard to practical surgery, and he would like to receive any information on the subject.

Dr. D. S. LAMB of Washington showed the following specimens :

TWO STERNA,

from two female mulatto infants, one of which, 47 months old, died of rickets; the other, 22 months old, died of tubercular meningitis. The sternum of the younger child was larger and better developed than that of the child more than twice as old. The specimens served to illustrate the difficulty of estimating age by degree of development.

FISSURED STERNUM.

This was the remarkably fissured sternum of Dr. Groux, whom some of the Association had seen during life, and a full report of whose case was published in the "Annals of the Anatomical and Surgical Society" of Brooklyn, volume i, 1878-9, page 7, *et seq.*, and the sternum figured at pages 10 and 100. The lateral halves were joined only at the lower ends of the mesosternum (or gladiolus). The specimen was first given by his widow to the Society; afterwards was deposited in the Army Medical Museum. The condition, of course, was congenital—a fault of development.

EXTRA CARPAL BONE.

The bone occupied the lower inner angle of the right os magnum of a man 25 years old. It did not appear to have any morphologic value.

BILATERAL BONY ANKYLOSIS OF JAW.

The condyloid processes were firmly and smoothly fused with the zygomatic processes and glenoid fossæ and on left side fused also with the articular eminence. No osteophytes. Much atrophy of alveolar processes. Left molar teeth removed for purpose of taking food. From a mulatto woman, age 48, whose jaw had been fixed for about 29 years. Said to have had a predisposition to scrofula; and when 19 years old had some ear trouble which was followed by the fixation. She, however, was not deaf and no post mortem was found. Dr. Lamb thought that the fall or blow on the chin confuting the allowed by arthritis, which in a scro-

fulous constitution might go on to ankylosis. She also gave a history of rheumatism, grippe, and malaria; no lesions of these diseases were found. The heart was normal.

EXAGGERATED PAPILLÆ ON GLANS PENIS.

The specimen consisted of the head of the penis of a negro, showing on the corona glandis a double row of hard, white papillæ, projecting backward; on the under side of the organ the row became single. The condition seemed to be rather rare; it resembled somewhat the marked papillary glans of felines and some other mammals, especially the guinea pig, and might be said to have reversionary value.

The anomaly seemed to be rare in the observation of those whose attention he had called to it. [But Sprunck in a Königsberg Dissertation (No. 23, 1897), "Ueber die vermeintlichen Tyson'schen Drüsen," stated that in 300 healthy men between 18 and 25 years of age, he found the glans smooth in 183, 61 p. c.; papillæ on glans and prepuce in 117, 39 p. c.; in two cases on glans, prepuce and in postcoronary sulcus; in eleven cases on one side only. In five cases they were small; one to two m. in thirty-eight; two to four m. in fourteen; four to five m. in thirteen. In nine cases there was but 1 series; in twelve cases 2 series; in twelve cases 3 series; in thirteen cases 4 to 15 series; in twenty-four cases the series were irregular. There was no sign in any of the men of glands, ducts or hair. He called the anomaly *Torus coronarius*, and figured a papillary crown of three series.]

DR. WILDER said that the specimen of ununited sternum (which was that of Dr. Groux) accounted for the condition observed during his life. When a student with Jeffries Wyman at Cambridge, 1859 to 1862, Dr. Wilder had examined Dr. Groux and felt the heart through the soft parietes when he voluntarily divaricated the sternum.

DR. HUNTINGTON said that the additional carpal bone appeared to be an instance of the condition described by Gruber as persistent epiphysis and supernumerary carpal bone derived from the styloid process of the third metacarpal. The fissured sternum was a beautiful example of the persistent embryonic condition of the bilateral sternal bar. In regard to the papillæ on the corona glandis the recent dissertation of Sprunck, in dealing with the question of Tyson's glands also took account of the macroscopic appearances of the glans and the presence of coronal papillæ.

A PRELIMINARY ACCOUNT OF THE COMPARATIVE ANATOMY OF THE CEREBELLUM.

Illustrated by Specimens and Diagrams.

BERT B. STROUD.

As stated in the writer's previous paper* on the development of the cerebellum in man and the cat, this organ has received comparatively little attention from anatomists. It might appear on first sight that our present knowledge is sufficient for the physician and surgeon. But really little is definitely known of the function of this organ or of its several parts. How shall we learn more? By experiment? Yes, but upon whom or what? Most of our experimentation must be done upon animals that are to be readily obtained, such as fowls, cats, dogs, rabbits, etc. How then shall we translate the results obtained into their human equivalents? If we stimulate or excise any part of a cat's or rabbit's cerebellum, how shall we locate with certainty the homologue of that particular area upon the human cerebellum? These questions have induced me to undertake to determine the homologies of the *mammalian* cerebellum.

The plan adopted has been to begin with the lowest and presumably the simplest forms and seek to trace the resemblances and differences up through the higher forms of increasing complexity until man is reached.

To obtain a complete idea of its morphology the study of the ectal features must be supplemented by an examination of sections, at least of a medisection. This should be done with both the adult organ in the entire mammalian series, and also with successive stages of embryos.

The ectal surface presents, in the turtle, a smooth convex outline. In the bird the surface is foliated. In the ornithorhynchus the structure is more highly developed but bears a general resemblance, with important differences, to that of the bird. In the opossum and other marsupials all the distinctive mammalian features exist.

Man presents one mesal and three pairs of lateral

Cerebellum Part I. The development of the cerebellum in man
Journal of Comparative Neurology," Vol. V, July, 1895, pp.
111.

1. The vermis, azygous.
2. The pileum, paired (hemispheres in man).
3. Parafocculus, paired; divided into suprafocculus and mediofocculus.
4. The flocculus, paired.

In man and some other primates, the flocculus and parafocculus are insignificant; the pileum constitutes the lateral mass of the cerebellum. But in the lower mammals the pileum, while retaining its distinguishing relation to the cerebellar peduncles, is relatively much smaller. The parafocculus and flocculus are relatively larger and they together with the pileum constitute the lateral mass of the cerebellum.

The mesal aspect shows—

1. That the cerebellum is the morphologic roof of the epicle.
2. That the ental supporting mass consists of alba, a thin plate in reptiles but corrugated in birds and mammals.
3. That the ental alba is clothed with cinerea.
4. That the roof is corrugated from the formation of sulci, some of which are deeper than others.

5. That the real thickness of the roof is the distance between the lining endyma and the bottom of the sulci between the corrugations.

6. That in all mammals from ornithorhynchus to man, one, the furcal sulcus, is deeper than the others.

In a shark, *squalus acanthias*, and in the crocodile, there is a single sulcus extending transversely across the meson. This is a total sulcus collocated with an ental ridge. In some alligators there is no sulcus but simply a depression. At present I do not feel certain that it is the precursor of the *furcal* sulcus, but suggest the possibility of such homology. The opinion of other observers is desired.

7. That there is a general similarity of arrangement with differences in detail throughout the entire class of mammals.

The *sulci* of the cerebellum.—The more important cerebellar sulci may be divided according to the time of their appearance, into three categories—

1. The first ones to appear are upon the latero-caudal aspect. These demarcate the flocculus and parafocculus from the pileum.

2. The second group appear at the meson (the vermis, as such, cannot yet be distinguished). These sulci begin at the meson as furrows which extend themselves laterad toward the right and left until they reach the lateral border of the cerebellar mass.

3. The third group belongs primarily to the pilea (lateral hemispheres). The sulci of this class differ from those of the second category in at least four particulars, viz:

a. They appear at a later period of development.

b. They are formed as two distinct sulci which begin as furrows at corresponding points upon either pileum and extend themselves, latero-ventrad and mesad.

c. They are usually deeper upon the pileum than upon the meson.

d. They are further distinguished by the facts, that—

1. The two furrows may terminate at the mesal borders of the pilea.

2. They may become confluent upon the meson, the one with its fellow from the opposite pileum.

3. The sulcus of one side may join a sulcus from the other side which lies either cephalad or caudad of its fellow. In either case the appearance is that of a single sulcus cutting the entire cerebellar mass.

In the present paper three sulci will be discussed, viz:

1. The furcal sulcus (*sulcus præclivalis*, Schäfer; or *antero-superior fissure*).

2. The cacuminal sulcus,* *sulcus cacuminalis* (*sulcus postclivalis*, Schäfer; or *postero-superior fissure*).

3. The peduncular sulcus (*sulcus horizontalis magnus*, or *great horizontal fissure*).

The *furcal sulcus* (*sulcus furcalis*). The earliest embryos of cat and man which I have examined, that present sulci at the meson, have none upon either pileum. There is a relatively wide and deep sulcus which divides the cerebellar mass into two parts, a cephalic and a caudal. See specimen No. 2,084, museum of Cornell University. This condition is very strongly marked at a little later stage of development and persists throughout the life of the individual.

Since this sulcus forms so early a morphologic division of the cerebellum and separates the arborescent appearance, seen in a mesal section, into two primary rami, I have proposed to designate it by the term *furcal sulcus* (*sulcus furcalis*). It corresponds to the *sulcus præclivalis* of Schäfer.

(*Antero-superior sulcus*.)—Notwithstanding the fact that so high
 27 ain's Anatomy, tenth edition, Vol. III, pp. 71-78,
 vary division of the cerebellum to be made by

67, Plate VII, Mammalian Cerebellum Part I. For *pedunc-*
leus. For *tuberal* s. read *peduncular sulcus*.

a different sulcus (*s. horizontalis magnus*), the writer insists upon the following grounds that the morphologic division of the cerebellum is made by the furcal sulcus.

1. It appears in man and the cat very early in development and divides the cerebellar mass into two parts long before the sulci of the third category have appeared. The smallest human fetus in the collection (museum of Cornell University) that shows any mesal sulci is 80 mm. long, No. 3547, male. Two sulci are present; one, the larger, is the furcal sulcus.

2. It begins at the meson and sinks deeply into the substance of the organ. And of the sulci that appear upon the dorsal aspect it most nearly reaches the cavity.

3. It is constant in the embryos of cat and man and in all adult mammals that I have examined.

4. It is deepest at the meson.

5. Its relation to the ental alba in all mammals examined is essentially as follows: On a mesal section the alba forming the arbor presents the appearance of two primary rami each of which divides and subdivides in general into branches, and ultimately into folia. The interval between the two rami is the furcal sulcus. It incises the mass so deeply that at this point there remains, between its ventral limit and the highest point of the dorsal extension of the epicele, only a very narrow mass of nervous substance; at the meson, indeed, the furcal sulcus almost cuts the cerebellum into two parts.

The *cacuminal* sulcus* (*sulcus postclivalis* Schäfer), and (*postero-superior sulcus*.) After the furcal sulcus has become well marked, there appears upon either pileum (lateral hemisphere,) a shallow furrow. See specimen No. 2,917, Mus. C. U. These two distinctly pilear sulci extend themselves latero-cephalo-ventrad to the ventral border and mesad to the mesal border of the pileum. They constitute what is described in Quain, Vol. III, p. 71, as the postclival fissure. Their further development is variable. The following five conditions have been observed:

1. In number 827, the two lateral furrows extend across the meson and join each other, so as to present the appearance of a single sulcus—deep upon each pileum, but shallow at the meson (vermis).

2. In Nos. 2,917 and 3,080 (fetuses), the left sulcus ends at the mesal border of the pileum.

3. In 2,917 (fetus), the right sulcus extends across the meson

*The following observations have been made upon fetal and adult human cerebellums, but the probability is that when corresponding stages of other mammals have been examined, these conditions will, in the main, be found to exist in them.

and joins the sulcus upon the left pileum which lies cephalad of the cacuminal sulcus.

4. In 3,131 (fetus), the right (cacuminal) sulcus joins the left peduncular sulcus (*s. horizontalis magnus*).

5. In 3,131 (fetus), the left sulcus crosses the meson but does not join any other sulcus upon the right pileum.

The *peduncular* sulcus, Wilder,—(*sulcus horizontalis magnus*), (*great horizontal fissure*). From the ectal surface of the human pileum the peduncular sulcus does appear to be the main sulcus. But a study of the mesal aspect and of embryos shows that this view is not supported by the facts. It lies next caudad of and appears later than the cacuminal sulcus (*s. postclivalis* Schäfer). So far as I can judge from available material its method of form-

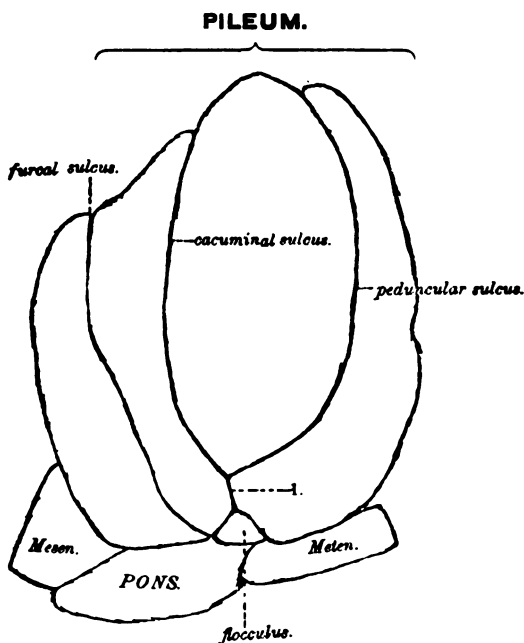


Fig. 1.

Figure 1, left lateral aspect of human cerebellum, No. 3,335. Outlines drawn camera lucida. Shows the general relations of the three sulci discussed in this paper. 1. The lateral junction of the cacuminal and peduncular sulci. The length of the common channel varies in different individuals; in a small number it is practically absent, but in the majority it varies from .5 cm. to 1.5 cm.

ation is like that of the cacuminal, *i. e.*, from two distinct pileal or lateral sulci. The two portions may or may not join at the meson. Among fifteen adult cerebellums examined, the following relations were found: peduncular sulcus, interrupted in 9; continuous in 2; and in doubt, 4; total, 15.

The majority of adult human cerebellums present a sulcus extending from the medipeduncle dorso-mesad transversely over the cerebellum. At a point varying from .5 to 1.5 cm. from the dorsal border of the medipeduncle it bifurcates into two sulci. Development shows that the cephalic branch (the cacuminal), is formed earlier than the caudal one (the peduncular). It thus appears that what in the adult is commonly regarded as the peduncular sulcus is really that sulcus plus from .5 to 1.5 cm. of the cacuminal sulcus. And practically the same statement is true for the fetus at term. But here, as in the adult, some variation is found. Further research on this point is necessary.

The commonly accepted opinion that the peduncular sulcus forms a primary boundary between the cephalic and the caudal regions of the cerebellum is rejected by the writer on the following grounds:

1. In formation it is preceded by another sulcus, the *furcal*, having a different mode of development and early dividing the cerebellum into a cephalic and a caudal portion.
2. From its development the peduncular sulcus must be considered secondary even to the cacuminal sulcus.
 - a.* The cacuminal sulcus extends from the medipeduncle to the mesal border of the pileum.
 - b.* The peduncular sulcus, even in comparatively late embryos, does not extend quite to the medipeduncles.
 - c.* And in the adult it appears to run into the cacuminal.
3. It is an interrupted sulcus.
4. It is deepest at about the middle of each pileum.
5. Its greatest depth is farther from the lining endyma of the roof than that of the furcal sulcus.
6. In the majority of cases examined it is either entirely absent or very shallow at the meson.
7. As seen in a mesal section when it reaches the meson at all it appears near the top of the postramus and serves to mark off a small tertiary branchlet. There is, however, considerable variation, and some published figures show the sulcus deeper than I have found it in any of my specimens.
8. It appears to me that the peduncular sulcus, like many others of the pileum, serves chiefly to increase the superficial area of potential ectocineria.

SUMMARY.

1. The anatomy of the cerebellum has been neglected by anatomists.

2. Experimentation must be upon such animals as are to be readily obtained.

3. The result of experiments cannot be translated into their human equivalents until homologies are definitely determined.

4. The study of ectal features must be supplemented by the study of sections, or at least the mesal aspect.

5. The entire mammalian series must be studied; both the adult brains and successive stages of embryos.

6. There is running through the whole series a fundamental plan.

7. The cerebellum is the roof of the epicele. It is foliated in birds and mammals.

8. All mammals examined present a transverse sulcus, the furcal s., which appears early and divides the cerebellum into two parts, a cephalic and a caudal.

9. In birds and the ornithorhynchus the cephalic part of the cerebellum (preramus) constitutes by far the larger portion of the cerebellar mass.

10. In the opossum and upward the postramus is relatively larger and all distinctive mammalian features exist.

11. In man especially and in lower primates largely the pileum constitutes the lateral mass of the cerebellum.

12. But in the lower mammals the lateral mass comprises both pileum (relatively small) and flocculus and paraflocculus, which are very large and presumably of more functional importance.

13. A mesal aspect shows,—

a. That all sulci are not of equal depth, and that one, the *furcal*, is deeper than the others.

b. The relations and general appearance of the arbor.

c. The appearance in section of the pre- and post-ramus.

14. From the time of their appearance sulci are divided into three categories—

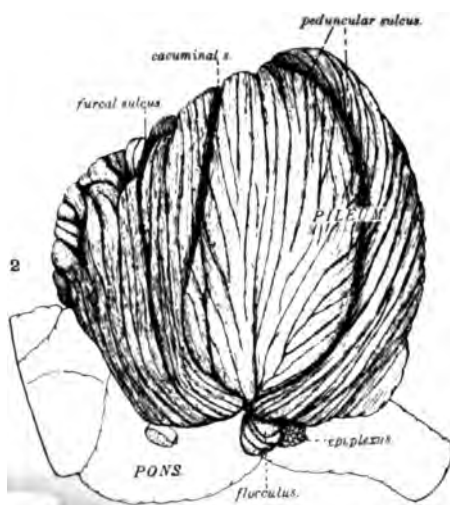
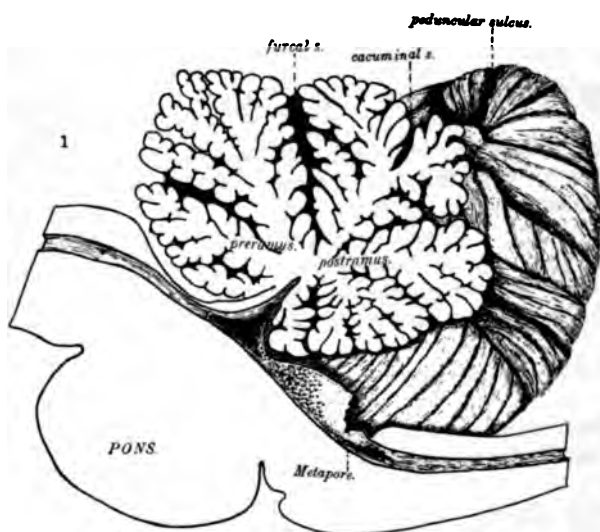
a. Those which begin on the lateral part and demarcate the d paraflocculus from the pileum.

which begin at the meson.

which begin upon the pileum.

meduncular sulcus does not form a primary division

Plate I.



1 cm. B. B. STROUD, del.

16. The general effect of sulci, especially those of the third category, is to give a larger surface of potential ectocinerea.

DESCRIPTION OF PLATE I.

Figure 1. Mesal aspect of the cerebellum of an adult male negro, No. 3,118. It is a plump, well developed organ. The outlines were traced from a photograph.

It shows—

- a. The tree-like appearance at the meson, divided by the furcal sulcus into a preramus and a postramus, each of which is divided by other sulci into branches and branchlets.
- b. That the furcal sulcus cuts most deeply into the substance of the cerebellum.
- c. The location of the cacuminal sulcus, and its shallowness *at the meson*.
- d. The location, and still less depth, *at the meson*, of the peduncular sulcus.
- e. The interruption of the metatela constituting the metapore.

Figure 2. Left lateral aspect of the cerebellum of an aged white man, No. 3,434. The outlines were drawn with a camera lucida.

It shows:

- a. The general foliated appearance of the lateral aspect.
- b. The relative positions of the principal sulci and numerous sulculi.
- c. The enormous pileum, constituting all of the cerebellar mass which lies caudad of the furcal sulcus, and the diminutive flocculus.
- d. The epiplexus.

DR. HUNTINGTON said: In view of the difficulties which especially the higher mammalian cerebella present in the interpretation of their complex fissural pattern, it is highly satisfactory to find that Dr. Stroud is developing a morphological basis for the classification of the variant conditions. Schwalbe's analysis of the human cerebellum is—as far as I know—the only one which combines the divisions of the cerebellar hemispheres with those of the worm, and in so far marks a distinct advance in cerebellar anatomy. It does not, however, afford any points for connection with the cerebellum of lower vertebrates, and I trust that Dr. Stroud's further researches will completely demonstrate the morphological value of his furcal fissure.

DR. WILDER said he would like to state his conviction of the accuracy with which Dr. Stroud's drawings represented the preparations. It would be premature to recognize as the precursor of the furcal sulcus of mammals the single transverse furrow in the crocodile embryo that was prepared by him 25 years before. Perhaps the absence of such sulcus in the alligator, might be correlative with a less degree of muscular activity.

THE DEFINITIVE ENCEPHALIC SEGMENTS AND THEIR DESIGNATIONS.

[Illustrated by Specimens and Diagrams.]

DR. B. G. WILDER, CORNELL UNIVERSITY, ITHACA, N. Y.

[Abstract.]

The speaker admitted the existence of difficulties in the way of a satisfactory solution of the problems here involved; discussed what he regarded as objectionable features of the segmental schema adopted in 1895 by the Anatomische Gesellschaft; formulated certain propositions as to fact and principle; and urged that there be recognized for the present, six definitive segments of the vertebrate brain under the titles Rhinencephalon, Prosencephalon, Diencephalon, Mesencephalon, Epencephalon and Metencephalon; this is the schema given in the last three editions of Quain's "Anatomy," excepting that segmental value is not there accorded to the olfactory division of the brain, and *diencephalon* is merely a synonym of *thalamencephalon*. The assignment of parts to the several segments advocated by the speaker is indicated in the following table.

DR. HUNTINGTON said: I quite agree with the propriety of Dr. Wilder's division and terminology, and believe that anatomists generally will support him in his attitude against the changes inaugurated in the segmental terminology by the German Committee. I would like to ask Dr. Wilder concerning the division of the Rhinencephalon shown on one of the plates, as I am not acquainted with any form which exhibits this division. It has an especial interest for me in view of a variant human brain, which Dr. Blake will show to the Association, in which there is a distinct reduplication of the precommissure.

Provisional Grouping of the Principal Neural Parts according to their Segments and some other Characters.

1. Chief constituent in mammals.	2. Segment.	3. Cavity.	4. Membranous portion.	5. Plexus.	6. Thin and Riparian parts.	7. Commissures, etc.	8. Some other parts.
I. Bulbi olfactorii.	Rhinencephalon.	Rhinocœlia.	Rhinotela (in some "fishes").			Præcommissura (pars olfactoria).	Præcibrium; limen.
II. Pallium.	Prosencephalon.	Prosocœlia (including the mesal aulla and lateral paracœliæ).	Prosotela (including the mesal aullatela and lateral paratela).	Prosoplexus (including the mesal auliplexus and lateral paraplexus).	Tænia; fimbria; pala; terma.	Præcommissura (pars temporalis) callosum; fornix.	Insula; lenticula; caudatum; paraphysis.
III. Thalami.	Diencephalon.	Diacœlia.	Diatela.	Diaplexus.	Habena.	Supracommissura; mediacommissura; chiasma.	Posteriorum; tuber; hypophysis; epiphysis; genicula.
IV. Quadrigeminum.	Mesencephalon.	Mesocœlia.	Mesotela (in the lamprey).		Valvula.	Postcommissura; decussationes tegmentorum.	Crus; tegmentum; crusta; lemniscus; intercalatum.
V. Cerebellum.	Ependymalon.	Epicœlia.	Epitela.	Epiplexus.	Lingula.	Pons.	Præoblongata; vermis; flocculus; dentatum.
VI. Postoblongata.	Metencephalon.	Metacœlia.	Metatela.	Metaplexus.	Metaporus; ligula; obex.	Decussatio pyramidum.	Pyramis; oliva; trapezium.
VII. Myelon.	Myelon.	Myelocœlia.	Myelotela (in lumbar enlargement of birds).			Commissura ventralis; c. dorsalis.	Conus; filum.

THE POSSIBLE MORPHOLOGICAL BASIS FOR SOME DISEASES OF THE LUNG.

DR. WOODS HUTCHINSON, BUFFALO, N. Y.

[Published in the "Medical Record," New York City, July 31, 1897, p. 145.]

DR. HUNTINGTON said: I have listened with great interest to Dr. Hutchinson's paper. The morphological side of the question with which he deals has long occupied my attention. During the last four years I have carefully studied the pulmonary vascular supply and bronchial system of a large number of mammalia, and I am firmly convinced that further researches in this direction will throw much light on the somewhat puzzling conditions presented in the majority of forms by the apical portion of the right and left lung. Even with the results at present available it is quite apparent that the asymmetrical right eparterial system and, to a certain extent, the cardiac bronchus both represent the end stages of a series of changes which have taken place in the evolution of the right lung, characterizing the same, in contrast to the left lung, as the more important respiratory organ. The facts and statistics which Dr. Hutchinson adduces are of the greatest interest in this connection.

ON BRAIN PRESERVATION.

BERT B. STROUD.

[Abstract.]

The object of all brain preservation may be said to be to retain the tissue in a condition as natural as possible and useful for future study. Of the many published methods few, if any, are of universal application. A particular method is required to obtain an especial result.

From a chemical standpoint, the brain is a mixture of heterogeneous principles which, together with the reagents we employ, are governed by definite chemical laws.*

*For valuable results as to the action of reagents on nerve tissue, see a paper by Prof. H. H. Donaldson, "Preliminary observations on some changes caused in nerve tissue by the reagents commonly employed to harden them." *Journal of Morphology*, January, 1894, p. 122.

The writer prefers alcohol as a preservative for brains to be dissected by general students because—

1. Plexuses and membranous parietes are preserved and the specimen is on the whole more useful.
2. The brains are quite tough.
3. They will bear without serious injury the rough treatment of the average beginner.
4. The student can see for himself that the cavities are really circumscribed.

Yet alcohol when used alone has the disadvantage of being of a less specific gravity than the brain, and there occurs a distortion of the specimen which cannot be entirely prevented by support upon absorbent cotton.

Having these points in mind I have endeavored to overcome the disadvantages of alcohol and now offer the following mixture:

Sodium acetate (fused),	130 gm.
Sodium chloride,	110 gm.
Formal (40 per cent. Formaldehyde),	20 cc.
Alcohol,	460 cc.
Water,	540 cc.

Dissolve the sodium acetate and the sodium chlorid in 540 cc. of water. Cool and filter, then add 460 cc. of 95 per cent alcohol.

For an ordinary sheep's brain allow about 400 cc. of the liquid. For larger brains a proportional amount.

Brains should be first placed in brine for twelve to twenty-four hours, to remove blood. They should remain in this solution ten to fifteen days; but a longer period is not harmful. Then they may be put into 75 per cent. alcohol which should be changed once or twice. They may remain indefinitely in 75 per cent. alcohol, or preferably put into 82 per cent. alcohol and finally into 95 per cent. alcohol. After ten days there is but little change in weight.

Crystallized sodium acetate may be used in place of the fused, but a larger amount would be required.

The advantages claimed for this solution are:

1. The mixture is simple and may be prepared at a moderate cost, about 14 cents per liter, alcohol free of tax.
2. It has about the same specific gravity as that of the brain. If the brains float on the top, add 50 per cent. alcohol until they sink below the surface.
3. The specimens have a more natural appearance than when some other preservatives are employed.

4. There is no distortion.
5. It appears to give good results for brains which are very soft from decomposition. In these cases the pia cannot be easily removed.
6. Plexuses and membranous parietes are preserved.
7. The alba and cinerea are visibly differentiated.
8. The good qualities of both alcohol and formal are retained without their more objectionable features.
9. The pia may be readily removed after a few days, except in the case of brains in which decomposition is far advanced.
10. Brains are moderately flexible, so that fissures may be explored.

VENTRAL VERSION OF SECONDARY FOREBRAIN.

Illustrated by Specimens and Diagrams.

DR. G. S. HUNTINGTON, NEW YORK CITY.

[The MS. of this paper has not yet been received.]

AN EXAMINATION OF THE SPINAL EFFERENTS FOR THE CEREBRO-SPINAL FLUID.

DR. WM. BROWNING, BROOKLYN, N. Y.

[Published in his "Normal and Pathological Circulation in the Central Nervous System," Philadelphia, 1897, pp. 1 to 20.]

THE CEREBRAL CONVOLUTIONS OF TWO BRAINS FROM NATIVES OF BRITISH GUINEA.

Illustrated by Specimens and Diagrams.

DR. G. S. HUNTINGTON, NEW YORK CITY.

[The MS. of this paper has not yet been received.]

DR. WILDER said that the paper was extremely interesting and instructive to him. He was particularly impressed with the fact that in both these savages there occurred on both sides the complete isthmus separating the parietal and the paroccipital

fissures. This condition existed in only nine, or 15 per cent., of the sixty pairs of hemicerebrums tabulated by him, and in neither of the three negroes included. (See Proceedings of Eighth Session of the Association, p. 71.)

DR. F. J. SHEPHERD of Montreal showed a specimen of

DOUBLE INTERNAL CUNEIFORM BONE

of the right foot of an adult male. In the left foot the internal cuneiform was bifid. The right first metatarsal bone had its kidney-shaped articular surface divided into two parts by a fissure to correspond to the double cuneiform. He regarded this condition as probably due to dichotomy. It was perhaps the beginning of the formation of a pre-hallux. Whether or not it was a reversion he was unable to say. Prof. Bardeleben would no doubt look upon it as a reversion to the seven digit type.

Dr. Shepherd also showed skiagraphs of both hands and feet of a girl, age 17, with supernumerary digits. In the skiagraphs of the feet it was interesting to notice that the internal cuneiform bones were bifid to articulate with the hallux and pre-hallux. In addition to the pre-pollex in each hand a small post-minimus had existed but was removed in babyhood. In the left hand the pre-pollex articulated largely with the pollex, only a small portion of the articular surface being in contact with the trapezium. In the right hand the pre-pollex articulated wholly with the pollex. Both supernumerary thumbs were used and provided with special muscles. The fingers of both hands were each provided with a pair of sesamoid bones. In each foot the supernumerary hallux was bent in towards the great toe, having the appearance of a thumb. The terminal phalanx of the hallux in left foot was bifid and the terminal phalanx of the fifth toe on the right foot was also bifid and very broad.

There was no history of heredity in this case on either side, at least for several generations.

DR. HUNTINGTON said that Wenzel Gruber had described the anomaly, distinguishing, he thought, between perfect and imperfect division of the bone.

DR. W. P. CARR of Washington showed the following anatomical models which he had made for use in illustrating his lectures, and made explanatory remarks.

1. Model of heart and circulation of blood. 2. Model showing formation of bloodvessel. 3. Model showing the corona radiata.

[Dr. Carr has not furnished notes for publication.]

A CONTRIBUTION TO THE TOPOGRAPHICAL ANATOMY OF THE MEDIASTINUM AND THE SUPERIOR APERTURE OF THE THORAX.

Illustrated by Specimens and Diagrams.

DR. JOSEPH A. BLAKE, NEW YORK CITY.

The dissection of the thorax in subjects ordinarily prepared does not afford us a true insight into the relations of the viscera as they exist during life, chiefly because of the softness and relaxation of the tissues which allow the organs to take abnormal positions. Sections of hardened subjects are valuable, but only give the relations of organs at certain points in their extent, and thus it is exceedingly difficult to obtain from them a mental picture of their entire relations.

Dissections of hardened subjects afford us the best ideas of visceral relations. In the preparation of such dissections formaldehyde has proved an invaluable ally. When used as an intra-arterial injection the vessels become fixed in a distended position, as in life, and the viscera become firm and elastic.

Preparations from such subjects are far more instructive than those made by other methods. They are easily preserved in solutions of formaldehyde or alcohol without change, and, also, because of their firmness and elasticity, they readily admit of casts being taken from them in plaster.

These casts when colored, preferably schematically, are valuable adjuncts to class demonstrations, since they convey at a glance the nature of the structures and at the same time their relations.

The object of this paper is to present as nearly as possible the normal relations of the lungs to the structures of the superior mediastinum and to those structures which form, by closing in the superior aperture of the thorax, what is called the dome or roof of the pleural cavity.

The descriptions are of preparations from formalized subjects, and the drawings were made from casts of the same preparations. In preparing the dissections, a transection of the body

was first made, passing through or just below the second costal cartilage in front, and the spinal column in the region of the sixth thoracic vertebra. At this level the plane of section passes through the upper part of the roots of the lungs. When the apices of the lungs are removed, a comprehensive view from below is obtained of the roof of the thorax, with all the superior mediastinal structures *in situ*.

In one preparation (Fig. V,) no further dissection was made; while in the others the pleura was removed and the structures dissected into relief, only enough of the intervening tissue being left to preserve their original relations. Thus some structures become apparent which do not actually come into direct relation with the pleura, being separated from it by sub-pleural fat and other tissues which are chiefly remains of thymus, and lymph nodes, peribronchial and otherwise, bound together by a loose connective tissue.

Preparations were made from five subjects illustrating the superior mediastinum and thoracic roof, and casts were taken from all. The drawings were made from three of these to illustrate the main variations. Slight differences will be noted in Figs. III and IV, which are practically of the same region.

In the preparation from which Fig. III was drawn, the thorax was narrow, the apices being pointed,* while in that from which Fig. IV was drawn the thorax was more expanded and the apices dome-like.† In the latter the structures of the mediastinum were more separated, thus allowing a greater exposure of the deeper ones, so accounting for the appearance of the left common carotid artery in Fig. IV, while in Fig. III, it is hidden by the sub-clavian.

The preparation from which Fig. V was drawn was made from the thorax of a woman of 70 years who had an aneurism of the aorta. In this preparation the pleura was left intact, and comparison casts (Figs. VII, VIII, IX and X) were made to illustrate the relations to and the impressions of the thoracic structures upon the lungs. These casts were made directly from the thorax rather than from the lungs themselves, as the lungs were not sufficiently firm in this subject to admit of successful casting.

Before describing the relations of the lung to the roof of the pleural cavity, I wish to first call attention to the manner in which the superior aperture of the thorax is closed to form a dome or roof, and especially to the part played by the *scaleni* in this connection.

* Phthisical Type. † Emphysematous type.

By the superior aperture of the thorax I refer more particularly to the space on each side between the first rib and the mediastinum.

The *scaleni* are a group of muscular slips which can be considered as having a common origin from the transverse processes of the cervical vertebræ and are inserted in nearly the whole length of the first rib and also to the second.

The portions inserted in the first rib are thus seen to form the segment of a cone whose apex is at the origin of the lower slip, namely, at the transverse process of the seventh cervical vertebra, and whose base is formed partly by the first rib. If the *scaleni* alone formed the roof of the pleural cavity, the apex of the lung would reach as high in the neck as the transverse process of the seventh cervical vertebra; but we find other structures beneath the *scaleni*, namely, the subclavian artery and the lower nerves of the brachial plexus (Figs. I and II, S. A. and C. VIII—T. I.) which not only crowd the apex of the lung down to the level of the neck of the first rib, but also nearly completely hide the *scaleni* from view from below.

The *scalenus anticus* passes from its origin down to the inner border of the first rib and its upper or outer surface. The deep surface of the muscle appears by a narrow margin for a distance of one-third to three-quarters of an inch in the thoracic cavity between the subclavian artery and vein and lying to the outer side of the int. mammary artery (Figs. I and II, Sc. A.). Behind the artery is a broad process of fascia (Figs. I and II, Sc. F.), occasionally containing a few muscle fibers, which springs from the transverse process of the seventh cervical vertebra and passes down to the first rib separating the artery from the eighth cervical nerve. This fascial slip appears for a greater distance in the thoracic cavity and forms a larger part of its summit than the *scalenus anticus*. At its insertion in the rib it spreads out and in front fuses with the *scalenus anticus* below the artery for a distance of one-third to one-half an inch.

By its fusion with the *anticus* it forms a sling by which the subclavian artery is held up above the upper or inner border of the first rib. The artery is thus suspended from the rib for the length of the fusion, which is about half an inch (Figs. I and II).

This arrangement contributes considerably to the length of

†1 tion of the artery.

Dissections made, five in number, the elevation of the rib was constant on both sides, being due to the fusion of the fascial slip with the *anticus*. In view from above the slip is found to come from the

transverse process of the seventh cervical vertebra, and appears more closely connected at its origin to the *medius* than to the *anticus*; while below, at its insertion, it is fused chiefly with the *anticus*, but also spreads out backward along the rib and below the eighth cervical and first thoracic nerves toward the insertion of the *medius*. And when the *medius* appears in the thoracic cavity, as in Fig. II, the slip fuses with it also.

The fusion of this slip with the *anticus* and *medius* supports the supposition that the *scaleni* are a single muscle which has been divided by the structures passing through it. The slip, when muscular, corresponds to the *scalenus minimus* of Albin.*

The pleura is connected to this slip as well as to the *anticus* by loose connective tissue, thus probably giving rise to the so-called *scalenus pleuralis*,† of Sibson and the lig. Pleuro-vertebrale and Pleuro-costale of Zuckerhandl.‡

The *scalenus medius* only occasionally appears in the thoracic cavity, its deep or thoracic surface being entirely hidden by the eighth cervical and first thoracic nerves, which are generally in contact with the internal intercostal muscle of the first space. (Fig. I.)

In regard to the other muscles of this region, I find that the internal intercostal muscles are, as a rule, concealed in the region of the angles of the ribs by the subcostal group (*transversus thoracis posterior*) of muscles which are rather atypical in their arrangement. The internal intercostal of the first space, however, is an exceedingly well developed muscle, and commences close to the head of the rib. Its innermost fibers are large and, as a rule, entirely conceal the proximal part of the first rib and are in contact with the eighth cervical and first thoracic nerves.

The structures closing in the superior aperture of the thorax are from before backward on both sides:

1. The subclavian and int. jugular veins.
2. The anterior scalenus muscle.
3. The subclavian artery.
4. The fascial slip from the transverse process of the seventh cervical vertebra to the first rib.
5. The eighth cervical and first thoracic nerves.
6. The inferior cervical and first thoracic ganglia of the sympathetic.

Of these, the subclavian artery and vein cross the lung in front of the apex, a small portion of the lung rising behind the

* For the variations of the *scaleni* see Henle, Anatomie d. Menschen, Muskel-lehre, p. 132.

† Quain's Anatomy, Vol. II, Pt. II, p. 130.

‡ Joessel, Lehrbuch d. topograph. chirurg. Anat., II Theil, 1 Abtheil, S. 54.

artery, as can be seen in the figures of the lung casts, but passing no further upward than the nerves (eighth cervical and first thoracic), which limit its incursion into the neck. The junction of the subclavian and internal jugular veins takes place just at the anterior border of the lung, and at a little distance below the subclavian artery on both sides, so that the left innominate vein is in relation with the anterior border of the left lung and the right innominate with that of the right lung. Also, the left innominate vein is in relation with the right lung (Fig. X).*

The subclavian artery forms a shallow sulcus on the lung which is limited to the apex on the right side (Fig. VIII), but on the left passes on to the inner aspect of the lung to meet the aortic sulcus (Figs. VII and IX). The internal mammary artery also forms a groove passing downward from the subclavian sulcus over the anterior surface of the lung.

The eighth cervical and first thoracic nerves form a slight impression on the outer aspect of the apex, while the last cervical and first thoracic ganglia of the sympathetic form a deeper impression on its posterior aspect.

The superior intercostal artery arches over the apex of each lung accompanied by the vein to the first intercostal space.

The phrenic nerve appears in the chest anteriorly, emerging between the subclavian artery and vein either to the inner or the outer side of the internal mammary artery. Contrary to the usual description, I have found it to lie more frequently to the inner side of the vessel. In two subjects it differed on the right and left sides, in two others it was internal to the artery on both sides. In one, external on both sides. When an accessory internal mammary artery is present the nerve appears not to wind behind the artery until it gets below the accessory branch (Fig. II).

The relations which the mediastinal structures bear to the right and left lungs differ markedly, as can be readily seen on referring to the figures of the lung casts, especially Figs. IX and X. On the left side they are almost entirely arterial, while on the right they are to a large degree venous.

The arch of the aorta is directed from the right border of the sternum to the left side of the vertebral column, and it crowds the trachea and occasionally the œsophagus so far to the right as to shut them out entirely from contact with the left pleura.

* In regard to the impressions made by structures on the lungs it will, perhaps, be well to state that observations were made on several *situs* preparations of lungs not figured in this paper, and assertions to that effect have only been made when such were regularly present.

Consequently, on the left side the only structures normally grooving the lung are the aorta and the subclavian artery. The left common carotid does not normally touch the pleura, being separated from it by the subclavian artery and mediastinal tissues. In the subject from which Fig. V was taken it impressed the lung, but this is due to the enlargement of the arch which has thrown the subclavian artery back against the vertebral column and the carotid outward.

The large aortic sulcus starting from the impression for the pericardium passes at first upward, then transversely across the lung above its hilum and then downward along its posterior border. Above the aortic sulcus the subclavian sulcus passes upward to the apex. Behind the subclavian artery the lung is separated, as a rule, by subpleural and mediastinal fat from the œsophagus and thoracic duct, which here passes upward across the left side of the œsophagus.

If the œsophagus be not pushed too far to the right by the aorta, it may come in contact with the left pleura for a short distance (Fig. III), although this appears to be the exception.

The left superior intercostal vein, as a rule, crosses the mediastinum from behind forward above the root of the lung, lying along the aortic arch to reach the left innominate (Figs. III and V, S. I. V.). Occasionally (Fig. IV) it joins the left superior hemi-azygos vein. The usual arrangement resembles that of the *azygos major* on the right side.

The left vagus nerve passes down over the left side of the arch and gives off its recurrent branch just before disappearing between the pulmonary artery and the arch. The phrenic passes downward more anteriorly in contact with the pericardium.

The relations of the right lung to the mediastinum are largely venous. The superior cava and its tributaries are all in direct relation to the lung, and the impressions for the *cava*, the *azygos major* and the right innominate are always well defined.

The right subclavian and internal jugular veins are in relation with the anterior border of the lung, and the lung, as it wraps around the pericardium, lies against the left innominate (Fig. X, L. I. V.).

Above the sulcus for the *azygos major* and posteriorly to the caval sulcus is a quadrilateral area (Fig. X), which presents a broad, shallow groove anteriorly, and posteriorly a lip. The groove is the impression of the trachea and the lip is in relation with the œsophagus. Behind the œsophagus the lung lies against the vertebral column and the right superior intercostal vein.

The vagus nerve appears in the thorax between the innominate vein and the trachea and then courses downward and backward across the trachea to reach the œsophagus in the interval between the right bronchus and the *vena axygos major*.

The phrenic nerve passes downward on the subclavian vein, right innominate vein and *vena cava*, reaching the pericardium between it and the *cava*.

EXPLANATION OF FIGURES.

FIG. I.

Roof of thoracic cavity, left side. ♂ Aet. 35. U. S.

Drawn from a cast of a dissection.

- I., II., III. 1st, 2d and 3d ribs.
- II. I. N. Second intercostal nerve.
- A. P. Accessory phrenic nerve.
- C. VIII.—T. I. Junction of 8th cervical and 1st thoracic nerves.
- I. C. G. At junction of inferior cervical and 1st thoracic ganglia of sympathetic.
- I. I. M. Internal intercostal muscle of 1st space.
- I. M. A. Internal mammary artery.
- L. I. V. Left innominate vein.
- L. V. Left vagus.
- O. Œsophagus.
- P. Phrenic nerve.
- S. A. Subclavian artery.
- S. I. A. Superior intercostal artery.
- S. V. Subclavian vein. The int. jugular vein unites with it just in front of the origin of the internal mammary artery.
- Sc. A. Scalenus anticus.
- Sc. F. Scalenus fascia.
- T. D. Thoracic duct.
- V. A. Ansa subclavia (Vieussens).

FIG. II.

Roof of thoracic cavity; left side ♂ Aet. 35. U. S.

Drawn from a cast of a dissection.

- I., II., III. 1st, 2d and 3d ribs.
- II. I. N. Second intercostal nerve.
- A. I. M. A. Accessory internal mammary artery.
- C. A. Left common carotid artery.
- C. VIII.—T. I. Junction of 8th cervical and 1st thoracic nerves.
- E. I. M. External intercostal muscle.
- I. C. G. Junction inferior cervical and first thoracic ganglia of sympathetic.
- I. I. M. Internal intercostal muscle.
- I. M. A. Internal mammary artery.
- L. I. V. Left innominate vein. The subclavian and int. jugular veins are not lettered in this figure.
- L. V. Left vagus.
- O. Œsophagus.
- P. Phrenic nerve.
- S. A. Subclavian artery.
- S. I. A. Superior intercostal artery.
- M. Subcostal muscles.
- S. A. Scalenus anticus.
- Sc. F. Scalenus fascia.

Sc. M.	Scalenus medius.
T. D.	Thoracic duct.
V. A.	Ansa subclavia (Vieussens.)

FIG. III.

Left side of superior mediastinum. ♂ Aet. 35. U. S.
 Drawn from the same cast as Fig. I. Phthisical type.

I., II., III., IV., V., VI. }	1st, 2d, 3d, 4th, 5th and 6th ribs.
I. I. N.	1st intercostal nerve.
A. A.	Arch of aorta.
A. P.	Accessory phrenic nerve.
A. V.	Vena azygos major.
C. VIII.—T. I.	Junction 8th cervical and 1st thoracic nerves.
I. C. G.	Junction inferior cervical and 1st thoracic ganglia of sympathetic.
E. I. M.	External intercostal muscle of 1st space.
I. M. A.	Internal mammary artery.
L. B.	Left bronchus.
L. I. V.	Left innominate vein.
L. V.	Left vagus.
O.	Esophagus.
P.	Phrenic nerve.
P. A.	Pulmonary artery.
Pc.	Pericardial sac; only its extreme upper part appearing.
R. B.	Right bronchus.
R. L.	Recurrent laryngeal nerve.
S. A.	Subclavian artery.
S. I. V.	Superior intercostal vein.
S. V.	Subclavian vein.
S. V. C.	Superior vena cava.
Sc. M.	Scalenus medius.
St.	Sternum.
T. A.	Thoracic aorta—(placed above its commencement).
T. D.	Thoracic duct.

FIG. IV.

Left side of superior mediastinum. ♂ Aet. 35. U. S.
 Drawn from same cast as Fig. II. Emphysematous type.

I., II., III., IV., V., VI. }	1st, 2d, 3d, 4th, 5th and 6th ribs.
I. I. N.	1st intercostal nerve.
A. A.	Arch of aorta.
B. A.	Bronchial artery.
C. VIII.—T. I.	Junction of 8th cervical and 1st thoracic nerves.
C. A.	Left common carotid artery.
E. I. M.	External intercostal muscle.
I. C. G.	Junction of inferior cervical and 1st thoracic ganglia of sympathetic.
I. I. M.	Internal intercostal muscle.
I. M. A.	Internal mammary artery.
L. B.	Left bronchus.
L. I. V.	Left innominate vein.
L. N.	Lymph nodes, enlarged.
L. P. A.	Left pulmonary artery.
L. V.	Left vagus.
O.	Esophagus.
P.	Phrenic nerve.
P. A.	Pulmonary artery.
Pc.	Pericardial sac.—separated from the vessels by effusion.

R. B.	Right bronchus.
R. L.	Recurrent laryngeal nerve.
R. V.	Right vagus.
S. A.	Subclavian artery.
S. H. V.	Superior hemiazygos vein.
S. I. A.	Superior intercostal artery.
St.	Sternum, cut between 2d and 3d costal cartilages.
S. V.	Subclavian vein.
S. V. C.	Superior vena cava.
Sc. M.	Scalenus medius.
T. A.	Thoracic aorta at its commencement.
T. D.	Thoracic duct.
V. A.	Ansa subclavia (VicusSENS.)

FIG. V.

Left side of superior mediastinum. ♂ Aet. 70. U. S.

Drawn from a cast of the thorax in which the pleura was left intact. Showing only the structures which are in direct relation with the lung. This figure shows a cylindrical aneurism of the aortic arch and consequent misplacement of the left common carotid and subclavian arteries.

I., II., III., IV., V., VI. }	1st, 2d, 3d, 4th, 5th and 6th ribs.
I., I. V.	Intercostal vein of 1st space.
A. A.	Arch of aorta—only the left half of its transection appearing in the drawing.
C. A.	Left common carotid artery.
C. VIII—T. I.	Junction of 8th cervical and 1st thoracic nerves.
I. J. V.	Internal jugular vein.
I. M. A.	Internal mammary artery.
L. B.	Left bronchus.
L. I. V.	Left innominate vein.
L. P. A.	Left pulmonary arteries.
L. V.	Left vagus.
O.	Œsophagus.
P.	Phrenic nerve.
P. A.	Pulmonary artery.
Pc.	Pericardial sac.
R. L.	Recurrent laryngeal nerve.
S.	Sympathetic.
S. A.	Subclavian artery.
S. I. A.	Superior intercostal artery.
S. I. V.	Superior intercostal vein.
St.	Sternum.
S. V.	Subclavian vein.
T. A.	Commencement of thoracic aorta.

FIG. VI.

Right side of superior mediastinum. ♂ Aet. 35. U. S.

From the same cast as Figs. II and IV.

, 3d, 4th, 5th and 6th ribs.
ercostal nerve.
racic ganglia of sympathetic.
of aorta.
azygos major.
hial artery.
n of 8th cervical and 1st thoracic nerves.
vical ganglion of sympathetic.

I. I. M.	Internal intercostal muscle.
I. M. A.	Internal mammary artery.
L. B.	Left bronchus.
L. C.	Longus colli muscle.
L. V.	Left vagus.
O.	Oesophagus.
P.	Phrenic nerve.
P. A.	Pulmonary artery.
Pc.	Pericardial sac.—separated from vessels by effusion.
R. B.	Right bronchi.
R. I. V.	Right innominate vein.
R. L.	Recurrent laryngeal nerve.
R. P. A.	Right pulmonary arteries.
R. V.	Right vagus.
S. A.	Subclavian artery.
S. I. A.	Superior intercostal artery.
S. I. V.	Superior intercostal vein.
St.	Sternum.
S. V.	Subclavian vein.
S. V. C.	Superior vena cava.
Sc. M.	Scalenus medius.
T.	Trachea.
T. A.	Thoracic aorta.
V.	Vertebral artery.
V. A.	Ansa subclavia (Vieussens).

FIG. VII.

Apex of left lung; viewed from above, showing impressions and relations of structures of thoracic wall and mediastinum.

From a cast from the same subject as Fig. V.

I., II.	Impression of 1st and 2d ribs.
C. A.	Impression of left common carotid artery.
C. VIII.—T. I.	Impression of lower trunk of brachial plexus.
I. C. G.	Impression of inferior cervical ganglion of sympathetic.
I. J. V.	Relation of internal jugular vein.
I. M. A.	Impression of internal mammary artery.
I. M. V.	Relation of internal mammary vein.
L. I. V.	Impression of left innominate vein.
P.	Relation of phrenic nerve.
S. A.	Impression of subclavian artery.
S. I. A.	Impression of superior intercostal artery.
S. V.	Impression of subclavian vein.
Sc. A.	Relation of scalenus anticus.
Sc. F.	Relation of scalenus fascia.

FIG. VIII.

Apex of right lung; viewed from above, showing impressions and relations of structures of thoracic wall and mediastinum.

From a cast from the same subject as Fig. V.

I., II.	Impressions of 1st and 2d ribs.
I. J. V.	Relation of first intercostal vein.
A. J. M. A.	Relation of accessory internal mammary artery.
C. VIII.—T. I.	Impression of lower trunk of brachial plexus.
I. C. G.	Impression of inferior cervical ganglion of sympathetic.
I. J. V.	Relation of internal jugular vein.
I. M. A.	Impression of internal mammary artery.
I. M. V.	Relation of internal mammary vein.
O.	Relation of oesophagus.

P.	Relation of phrenic nerve.
Pc.	Impression of pericardium.
R. j. V.	Impression of right innominate vein.
R. V.	Relation of right vagus.
S. A.	Impression of subclavian artery.
S. j. A.	Impression of superior intercostal artery.
S. j. V.	Impression of superior intercostal vein.
S. V.	Impression of subclavian vein.
Sc. A.	Relation of scalenus anticus.
Sc. F.	Relation of scalenus fascia.
T.	Impression of trachea.

FIG. IX.

Mediastinal aspect of left lung, showing impressions and relations of thoracic wall and mediastinum; abnormal relation of common carotid artery. Aneurism of aorta. From same cast as Fig. VII.

II.	Impression of 2d rib.
A. A.	To dotted line showing impression of the arch of the aorta.
C. A.	Impression of left common carotid artery.
j. C. G.	Impression of inferior cervical ganglion of sympathetic.
L. j. V.	Impression of left innominate vein.
L. P. A.	Left pulmonary arteries at hilum.
L. V.	Relation of left vagus.
P.	Relation of left phrenic nerve.
Pc.	Impression of pericardium.
R. L.	Relation of recurrent laryngeal nerve.
S. A.	Impression of subclavian artery.
S. j. V.	Relation of superior intercostal vein.

FIG. X.

Mediastinal aspect of right lung, showing impressions and relations of structures of the thoracic wall and mediastinum. From the same cast as Fig. VIII.

I., II.	Impressions of 1st and 2d ribs.
A. V.	Impression of vena azygos major.
j. C. G.	Impression of inferior cervical and 1st thoracic ganglia of sympathetic.
L. j. V.	Impression of left innominate vein.
O.	Relation of oesophagus.
P.	Relation of phrenic nerve.
Pc.	Impression of pericardium.
R. B.	Right bronchus.
R. j. V.	Impression of right innominate vein.
R. P. A.	Right pulmonary arteries.
R. V.	Relation of right vagus.
S. A.	Impression of subclavian artery.
S. j. V.	Impression of superior intercostal vein.
S. V. C.	Impression of superior vena cava.
T.	Impression of trachea.

DR. HUNTINGTON said: I can hardly overestimate the value of Dr. Blake's investigations. They have opened up some entirely novel views of the Topographical relations of the mediastinal contents. Especially important are his results in reference to the structures closing the superior thoracic aperture. I can vouch for the extreme care and skill with which the work has

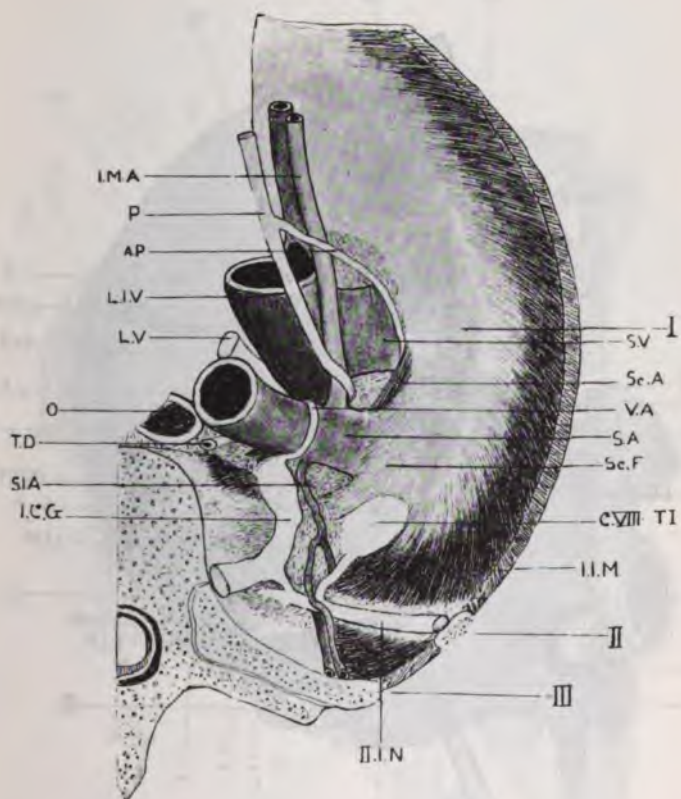


Fig I

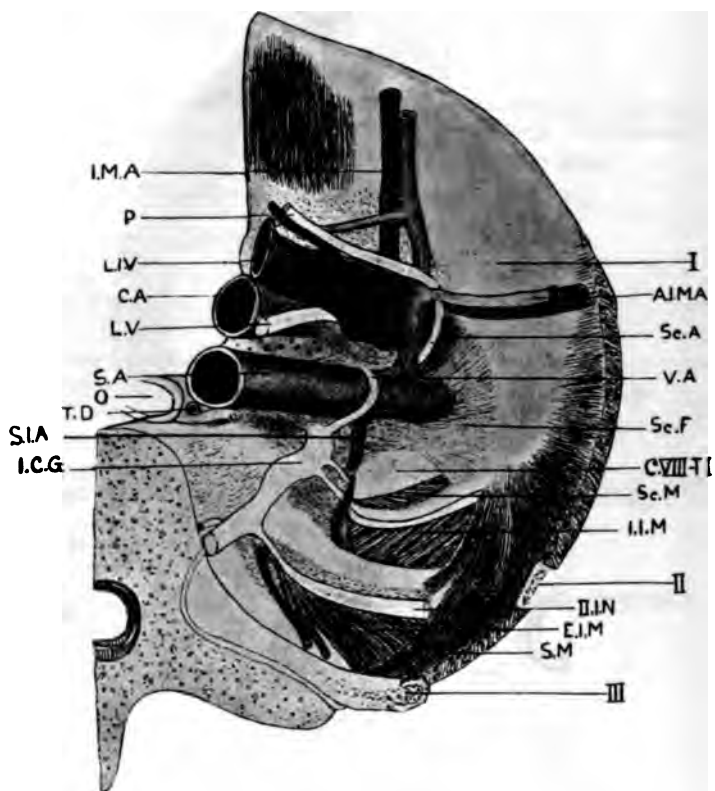


Fig. II

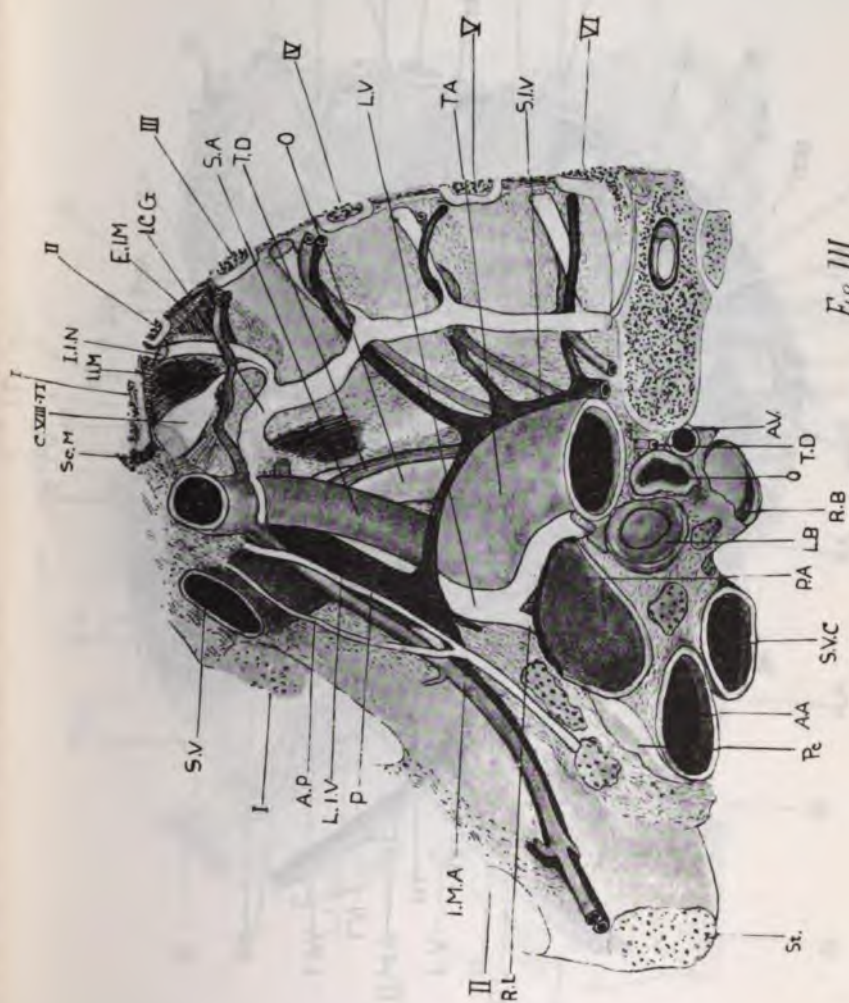
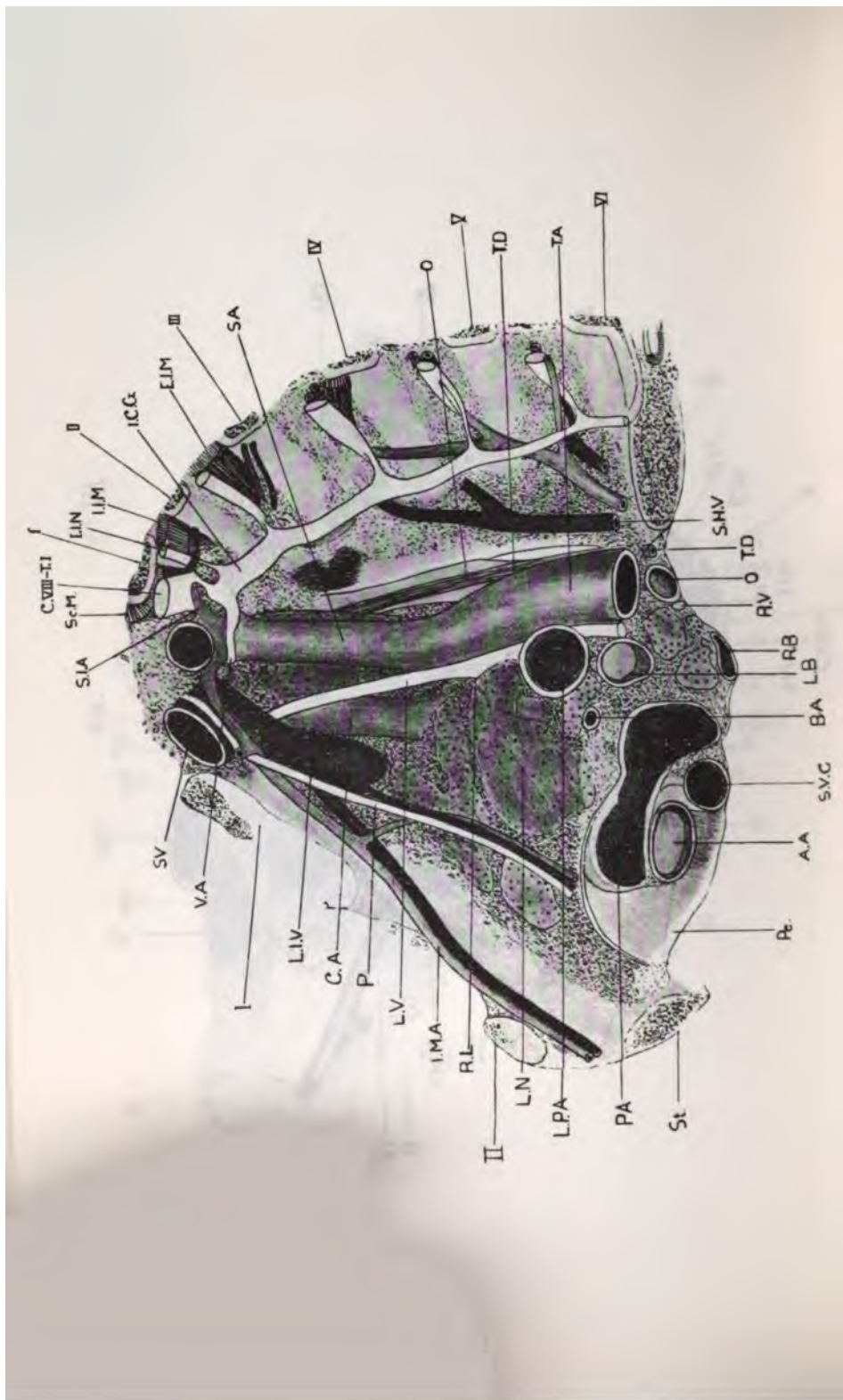
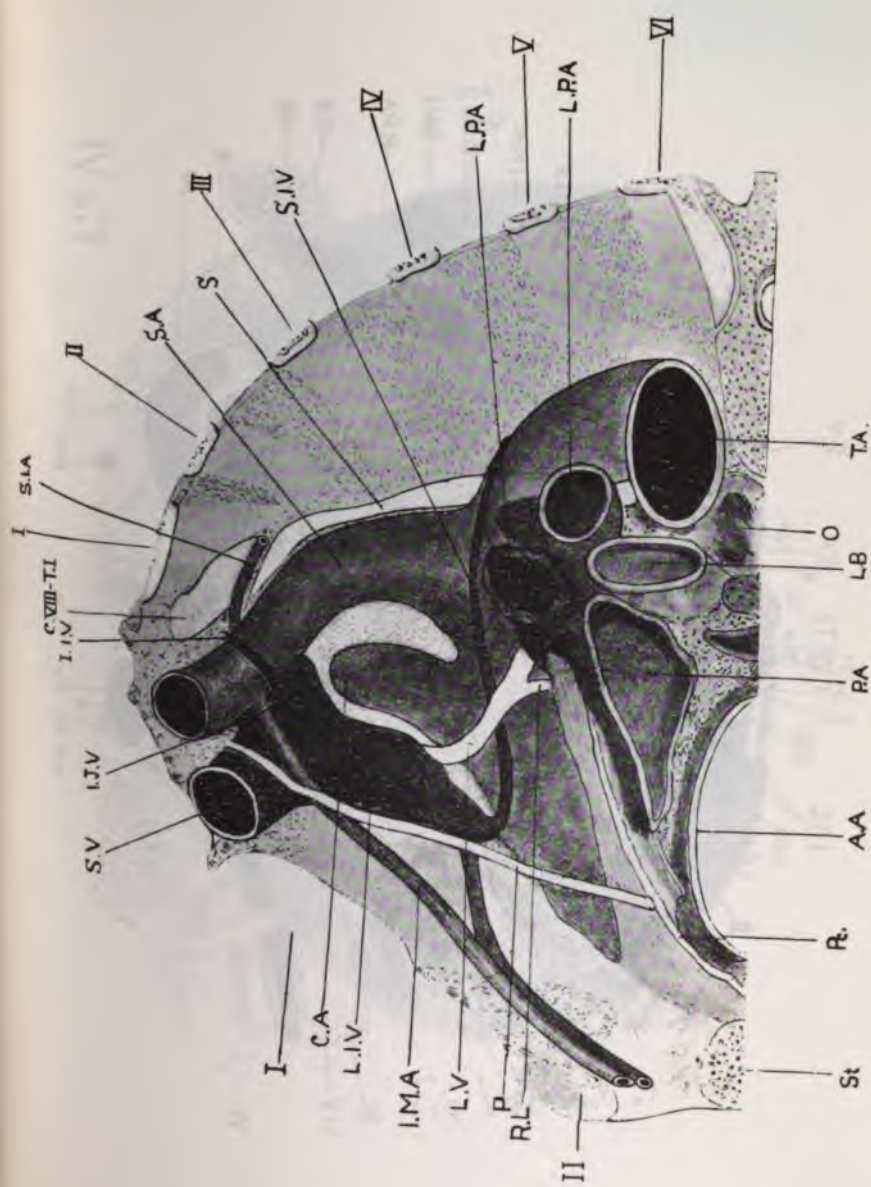


Fig. III





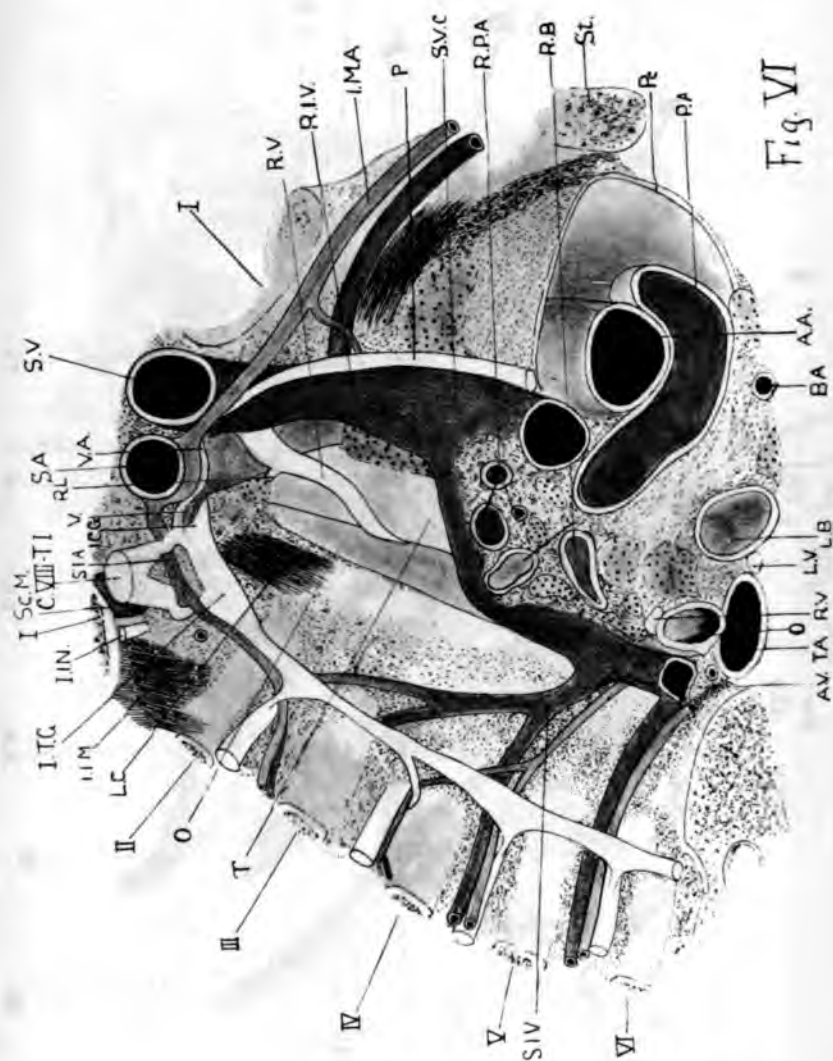


Fig. VI

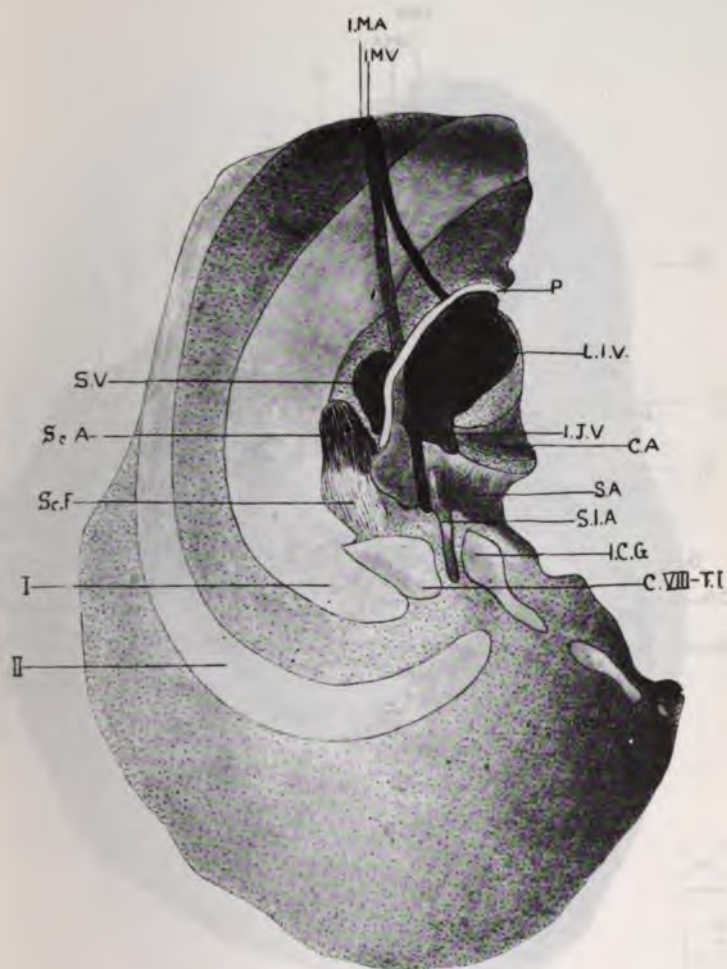


Fig. VII

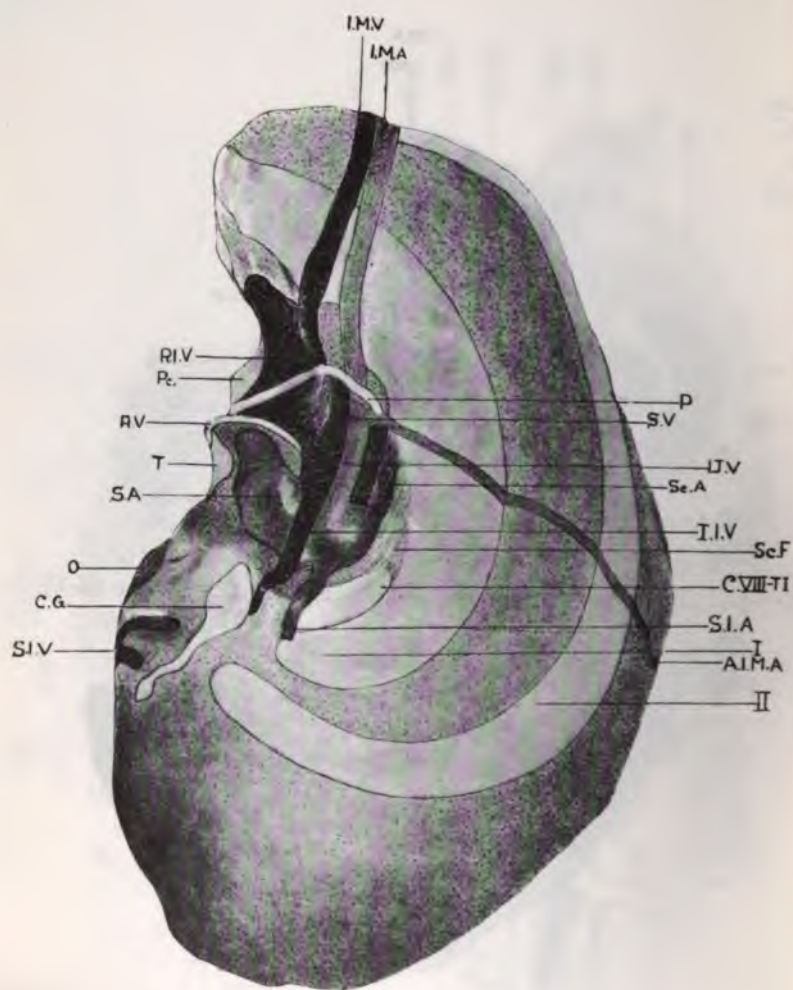


Fig VIII

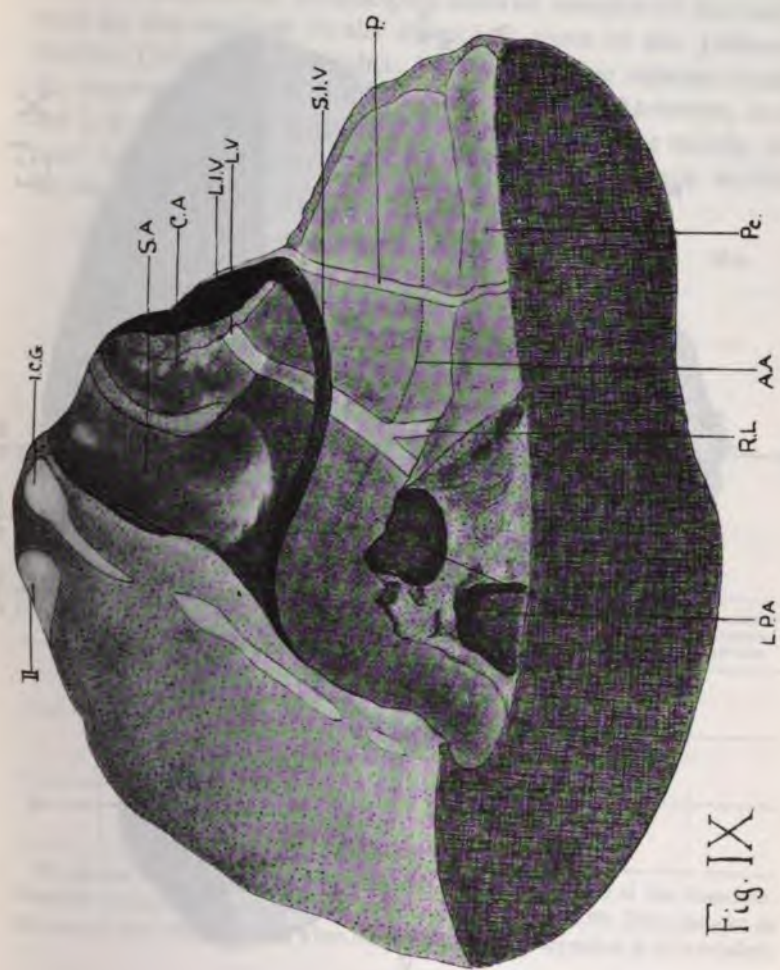


Fig. IX

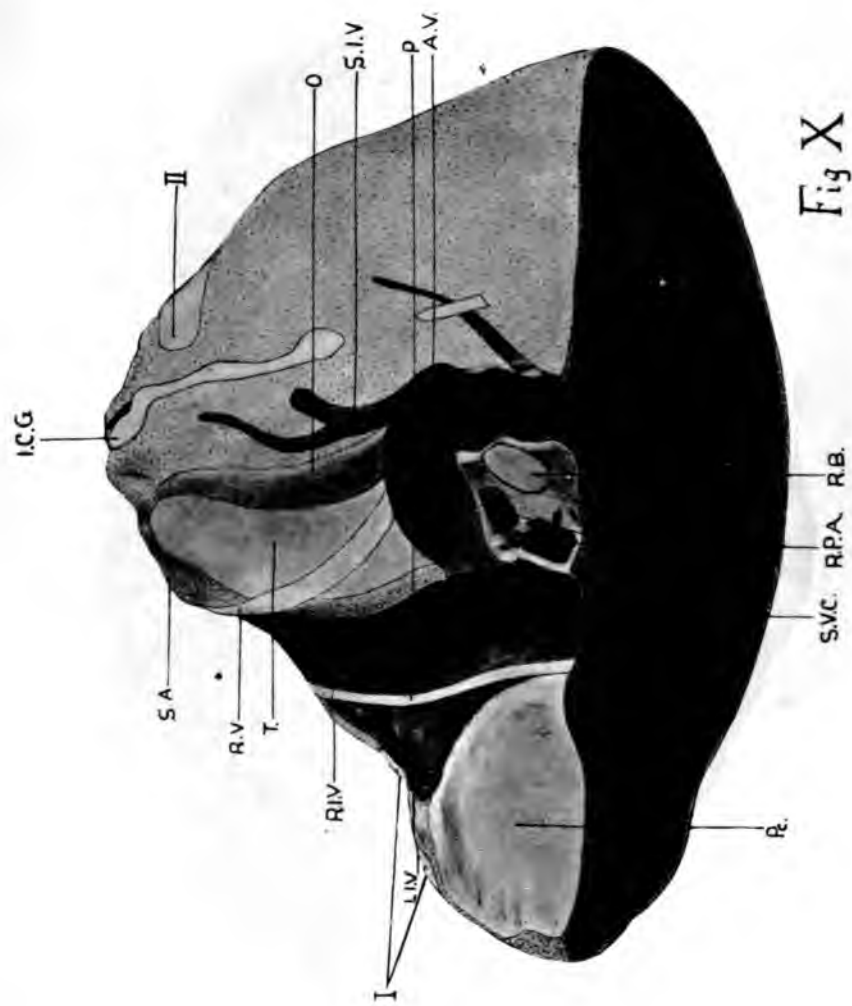


Fig X

been done, and I congratulate Dr. Blake on his valuable contribution to our knowledge of the topographical anatomy of the thorax.

Dr. A. Hewson of Philadelphia showed samples of the cards used by the students in the dissecting room of the Jefferson Medical College, Philadelphia. There were five separate cards, for, respectively, the Head and Neck, Thorax, Abdomen, Arm and Leg; they were made to fold transversely in the middle, the bend being reinforced on the back by a strip of black muslin. At the top of each card was the following:

Oct. Nov. Dec. Jan. Feb. Mch. Apl. May.

KEEP THIS CARD.

Name, *Date*,

at the bottom the following:

All anomalies must be recorded on the blanks furnished for that purpose.

All measurements and weights to be noted on the back of this card in ink.

and on the back the following:

DISSECTING ROOMS
OF THE
JEFFERSON MEDICAL COLLEGE.

Date of Demonstration.	Initials of Demonstrator.	Date of Demonstration.	Initials of Demonstrator.	Date of Demonstration.	Initials of Demonstrator.	Date of Demonstration.	Initials of Demonstrator.

The student must have at least six demonstrations in the course of the dissection. When the dissection is completed, this card must be handed to the Demonstrator at the time of his examination, when his signature will be appended if he is satisfied.

.....
Demonstrator.

There was also an *anomaly blank* as follows, on the back of which was to be a drawing showing the topography of the anomalies or variations noted.

HEWSON'S ANOMALY BLANK. ---

Student's Name.....

Note Anomalies or Variations (after referring to Morris' Anatomy), and have the same verified by a Demonstrator who signs this card. When examined on the part, this blank is to be returned to Dr. A. Hewson, Demonstrator of Anatomy, Jefferson Medical College.

Table No. , A. B. ; Sex

Prob. Age, ; Color.

Bones.

Muscles.

Arteries.

Veins.

Nerves.

Viscera.

Peritoneum.

Pericardium.

Pleura.

I have examined the above specimen, and report it correct.

....., M. D.,
Demonstrator.

On the back of this blank was the endorsement :

Drawing showing the topography of the anomalies or variations noted.

HEAD AND NECK.

*The Student must expose and exhibit to the Demonstrator
or his assistants the following structures :*

1	Scalp; Blood-vessels and nerves in same; Occipito-frontalis m.; Supra-	1	2	3	4
2	orbital n.; Occipital n.; Orbicularis palpebrarum m.; Corrugator super-	5	6	7	
3	ciliaris m.; Fascia of face; Parotid gland; Facial n.; Facial a.; Platysma	8	9	10	11 12
4	myoid m.; Infra-orbital n. and a.; Temporal m.; Attollens aurem m.;	13	14	15	
5	Retrahens aurem m.; Attrahens aurem m.; Pyramidalis m.; Levator labii	16	17	18	19
6	superioris alæque nasi m.; Orbicularis oris; Buccinator m.; Zygomaticus	20	21	22	
7	major m.; Levator anguli oris; Risorius m.; Depressor anguli oris m.;	23	24	25	
8	Levator labii superioris m.; Zygomaticus minor m.; Depressor labii inferi-	26	27	28	
9	oris m.; Depressor alæ nasi m.; Levator menti m.; Masseter m.; Ptery-	29	30	31	32
10	goideus mm.; Fasciæ of neck; Anterior jugular v.; External jugular v.;	33	34	35	
11	Great auricular n.; Occipital n.; Sterno-cleido mastoideus m.; Triangles	36	37	38	38½
12	of neck and their contents; Course and relations of common carotid a.;	39			
13	Difference between the right and left carotid aa.; Internal jugular v.;	40	41		
14	Descendens and communicans noni nn.; Thyroid gland; Deep cervical	42	43	44	
15	lymphatic glands; Examine position for operation of tracheotomy; Sub-	45	46		
16	maxillary gland; Sublingual gland; Course, relations, and branches of	47	48		
17	external carotid a.; Hypoglossal n.; Mylohyoid n. and m.; Stylo-maxillary	49	50	51	
18	lig.; Genio-hyoideus m.; Hyo-glossus m.; Stylo-glossus m.; Genio-hyo-	52	53	54	55
19	glossus m.; Gustatory n.; Submaxillary ganglion; Note position for ligation	56	57	58	
20	of lingual a.; Ligations possible in superior carotid triangle; Cervical plexus	59	60		
21	of nn.; Brachial plexus nn.; Scalene mm.; Note position of phrenic	61	62	63	
22	n.; Subclavian a.; Relations to parts and point of ligation; Explain con-	64	65	66	
23	dition of circulation after ligation; External pterygoid m.; Internal ptery-	67	68		
24	goid m.; Internal maxillary a.; Inferior maxillary n.; Branches of same;	69	70	71	
25	Ligg. of temporo-maxillary joint; Accessory ligg. to this joint; Pneumo-	72	73	74	
26	gastric n.; Spinal accessory n.; Hypoglossal n.; Sympathetic n.; Pharynx;	75	76	77	78
27	Superior constrictor m.; Middle constrictor m.; Inferior constrictor m.;	79	80	81	
28	Stylo-hyoid m.; Stylo-pharyngeus n.; Muscles of the prevertebral region;	82	83	84	
29	Venous sinuses of the skull; Position of the Gasserian ganglion; Contents	85	86	87	
30	of the three lacerated foraminæ; Foramen magnum; Fissures of brain;	88	89		
31	Lobes of the brain; Circle of Willis; Give relations that fissures of brain	90	91	92	
32	bear to inside cavities of the same; Contents of each ventricle; Boundaries	93	94		
33	of each ventricle; Means of communication between ventricles; Apparent	95	96		
34	origin of each of the cranial nn.; Demonstrate cerebellum; Boundaries	97	98		
35	of the orbit; Muscles of the eyeball; Coats of the eye; Light-transmitting	99	100	101	
36	media; Arterial and nervous supply to eyeball; Cartilages of the larynx;	102	103		
37	Exhibit the vocal bands; Cartilage of external ear; Give measurements of	104	105	106	
38	external auditory canal; Same of Eustachian tube, with position.	107			

THORAX.

*The Student must expose and exhibit to the Demonstrator
or his assistants the following structures :*

1	Fasciæ; Mammary gland; Relation of deep fascia to gland and mus-	1	2	3
2	cles; Lymphatic glands; Pectoral muscles; Axillary a.; Axillary v.; Bra-	4	5	6 7 8
3	chial plexus of nerves; Intercosto-humeral n.; Posterior thoracic n.;	9	10	
4	Serratus magnus m.; Subclavius m.; Relation of vessels and nn. in posterior	11	12	13
5	aspect of axilla; Intercostal mm.; Relation of intercostal artery to mus-	14	15	
6	cles, ribs, and pleura; Triangularis sterni m.; Position and relation of	16	17	
7	internal-mammary arteries to mediastinal space; Boundaries of anterior	18		
8	mediastinal space; Contents of same; Boundaries of middle mediastinal	19	20	
9	space; Contents of same; Boundaries of posterior mediastinal space;	21	22	
10	Contents of same; Boundaries and contents superior mediastinal space;	23	24	
11	Relations of the right and left innominate veins; Relations of superior	25	26	
12	vena cava; Position and relations of three portions of the arch of the aorta;	27		
13	Phrenic nn.; Difference in relations of the right and left phrenic nn.;	28	29	
14	Trachea; Heart; Note dimensions; Points mentioned in each auricle and	30	31 32 33	
15	ventricle; Position of heart in reference to chest-wall; Position of ven-	34	35	
16	tricles in relation to each other; Position of base of heart to vertebral	36		
17	column; Position of apex in relation to chest-wall; Position of heart not	37	38	
18	covered by lungs and relation to chest-wall; Venæ azygos; Thoracic duct	39	40	
19	and relations; Sympathetic n.; Splanchnic nn.; Spinal nn.; Pneumogas-	41	42 43 44	
20	tric nn.; Oesophagus; Pleural cavity; Relations of same; Lungs, position	45	46 47 48	
21	of; Relation of lungs at apex; Same at base; Formation of root of same;	49	50 51	
22	Differences in two lungs; Color in different ages; Attachments of dia-	52	53 54	
23	phragm to thoracic wall; Measure depth of thorax (intra-thoracic), in front,	55		
24	behind, and at sides; Ligaments of the sternum; Ligaments of the carti-	56	57	
25	lages; Ligaments of ribs; Ligaments uniting the vertebræ and ribs;	58	59	
26	Vertebral ligaments; Veins of cord; Arteries of Cord; Spinal cord.	60	61 62 63	

ABDOMEN.

The Student must expose and exhibit to the Demonstrator or his assistants the following structures :

1	Fasciæ separately; Superficial aa. and nn. in groin; Lymphatic glands	1	2	3
2	of groin; External oblique m.; External abdominal ring; Internal oblique	4	5	6
3	m.; Rectus abdominis m.; Transversalis m.; Pyramidalis m.; Deep epigas-	7	8	9 10
4	tric a.; Internal abdominal ring; Parietal peritoneum; Nerves in abdominal	11	12	13
5	muscles; Spermatic cord; Coverings of herniæ by the oblique and direct	14	15	
6	descent; Hesselbach's triangle; Canal of Nuck; Poupart's ligament;	16	17	18
7	Gimbernat's ligament; Scrotum; Adventitious and proper coverings of the	19	20	21
8	testes; Weight and dimensions of testes; Minute anatomy of testes;	22	23	
9	Mons veneris; Female external genital organs; Perineum dissected; Penis	24	25	26 27
10	dissected; Several folds of peritoneum; Inner region of abdomen;	28	29	
11	Arteries of the intestines; Veins of intestines; Lymphatics of intestines;	30	31	32
12	Portal vein; Method of distinguishing the several portions of the intestines	33	34	
13	from each other; Branches of abdominal aorta; Position and relation of	35	36	
14	pancreas; Weight and dimensions of same; Position and relations of	37	38	
15	stomach; Measurement and weight of stomach; Position and relations of	39	40	
16	liver; Measurement and weight of same; Position and relations of kidneys;	41	42	
17	Measurements and weight of same; Position and relations of ureter; Length	43	44	45
18	of ureter; Ascending cava; Receptaculum and relations; Crura of dia-	46	47	48
19	phragm; Internal and external arcuate ligaments; Lumbar plexus; Psoas	49	50	51
20	magnus m.; Psoas parvus m.; Quadratus lumborum m.; Iliacus m.; Com-	52	53	54 55
21	mon iliac a.; External and internal iliac aa., branches and relations; Internal	56	57	
22	femoral opening; Difference in relations of iliac veins; Bladder; Its	58	59	60
23	position and relations; Ligaments of bladder; Position and relations of	61	62	
24	the rectum; Arterial supply; Relation of portal vein to rectum; Nerves of	63	64	65
25	rectum; Levator ani m.; Internal sphincter ani; Fasciæ of perineum;	66	67	68
26	Muscles of perineum; Ischio-rectal fossæ; Position and relations of inter-	69	70	71
27	nal pudic a. and its branches; Position and relations of membranous and	72		
28	prostatic urethra; Position and relations of the uterus; Position and	73	74	
29	relations of ovary; Broad ligament; Round ligament; Position and relations	75	76 77	
30	of vagina; Arterial supply to each; Veins and nerves of each; Obturator	78	79	80
31	internus m.; Muscles of back down to erector spinæ mass; Ligaments of	81	82	
32	lumbar vertebræ; Ligaments uniting vertebral column to sacrum; Con-	83	84	
33	dition of spinal cord in bony canal.			

ARM.

*The Student must expose and exhibit to the Demonstrator
or his assistants the following structures :*

1	Fasciæ; Cephalic vein; Internal cutaneous nerves; Intercosto-	1	2	3	4
2	humeral n.; Deltoid m.; Biceps m.; Coraco-brachialis m.; Brachialis ant.	5	6	7	8
3	m.; Brachial a. and branches; Median n.; Ulnar n.; Musculo-cutaneous	9	10	11	12
4	n.; Axillary vessels; Teres major m.; Teres minor m.; Supra-spinatus m.;	13	14	15	16
5	Infra-spinatus m.; Subscapularis m.; Triceps m.; Musculo-spiral n.; Median	17	18	19	20
6	basilic v.; Median-cephalic v.; Relations of same at elbow to artery;	22	23		
7	Fasciæ of forearm with their contents; Pronator radii teres m.; Flexor	24	25	26	
8	carpi radialis m.; Palmaris longus m.; Flexor carpi ulnaris m.; Flexor sub-	27	28	29	
9	limis digitorum m.; Flexor profundus digitorum m.; Flexor longus pollicis	30	31		
10	m.; Pronator quadratus m.; Radial a.; Ulnar a.; Interosseous a.; Radial n.;	32	33	34	35
11	Brachio-radialis m.; Extensor carpi radialis longior; Extensor carpi radi-	37	38	39	
12	alis brevior m.; Extensor communis digitorum m.; Extensor minimi digiti	40	41		
13	m.; Extensor carpi ulnaris m.; Anconeus m.; Supinator radii brevis m.;	42	43	44	
14	Extensor ossis metacarpi pollicis m.; Extensor brevis pollicis m.; Extensor	45	46	47	
15	longus pollicis m.; Extensor indicis m.; Relation of radial a. to tendons;	48	49		
16	Relation of radial n.; Palmar fasciæ; Muscles of thenar eminence;	50	51	52	
17	Mm. of hypothenar eminence; Lumbricales mm.; Interossei mm.; Palmar	53	54	55	56
18	arches; Distribution of ulnar, median, and radial nn. in the hand;	57			
19	Relation of palmar fasciæ to palmar bursa; Shoulder lig.; Elbow lig.;	58	59	60	
20	Scapular lig.; Peculiarity of carpo-metacarpal joint of thumb; Wrist-joint;	61	62	63	
21	Relation of tendons on palmar surface of fingers; Relation of tendons on	64	65		
22	dorsal surface of fingers; Peculiarities of tendinous sheath of fingers; Ligg.	66	67		
23	metacarpo-phalangeal joints; Ligg. phalangeal joints; Ligg. radio-ulnar	68	69		
24	joints; Note ·	merus and ulna and relation of radius in	70		
25	flex-	mus on dorsum of wrist; Relations of	71	72	

*The Student must expose and exhibit to the Demonstrator
or his assistants the following structures :*

1	Fasciæ of anterior femoral region separately; Superficial blood-vessels	1	2
2	and nerves; Long saphenous v.; Femoral ring and structures appearing	3	4
3	there; Boundaries of Scarpa's triangle; Contents of Scarpa's triangle;	5	6
4	Relations of blood-vessels and nerves in same; Sartorius m.; Pectineus m.;	7	8 9
5	Adductor longus m.; Adductor brevis m.; Adductor magnus m.; Tensor	10	11 12 13
6	vaginæ m.; Crureus m.; Subcrureus m.; Femoral a., relations and	14	15 16
7	branches; Femoral vein, relations and tributaries; Obturator n.; Accessory	17	18 19
8	obturator n.; Gracilis m.; Rectus femoris m.; Vastus internus m.; Vastus	20	21 22 23
9	externus m.; Internal saphenous v. below knee with tributaries; Long sa-	24	25
10	phenous n.; Ext. cutaneous branches of peroneal n.; Muscular fascia and	26	27
11	annular ligg.; Tibialis anticus m.; Extensor longus digitorum; Peroneus	28	29 30
12	tertius; Extensor proprius hallucis m.; Course, relations, and branches of an-	31	32
13	terior tibial a.; Extensor brevis digitorum m.; Course, relations, and branches	33	34
14	of dorsal a. of foot; Peroneus longus m.; Peroneus brevis m.; Peroneal n.	35	36 37
15	and branches; Fasciæ of gluteal region; Cutaneous nn.; Gluteus maximus	38	39 40
16	m. and structures beneath; Gluteus medius m.; Gluteus minimus m.;	41	42
17	Gluteal vessels and nn. with their branches; Pyriformis m.; Obturator inter-	43	44 45
18	nus m.; Gemelli mm.; Quadratus femoris m.; Obturator externus m.; Great	46	47 48 49
19	sciatic n. with branches; Small sciatic n. with branches; Sciatic a.; Pudic	50	51 52
20	a. and v. with branches of each; Boundaries and contents of popliteal	53	
21	space with relations of same; Cutaneous nn. and vv. of calf; Muscular	54	55
22	fascia; Biceps m.; Semitendinosus m.; Semimembranosus m.; Gastroc-	56	57 58 59
23	nemius m.; Plantaris m.; Soleus m.; Course, relations, and branches of	60	61 62
24	popliteal a.; Popliteal v.; Popliteus m.; Flexor longus digitorum m.; Flexor	63	64 65 66
25	longus hallucis m.; Tibialis posticus m.; Relations of tendons behind	67	68
26	external malleolus; Relations of tendons behind internal malleolus; Course,	69	70
27	relations, and branches of posterior tibial a.; Posterior tibial n.; Cutaneous	71	72
28	nn. of sole of foot; Plantar fascia; Abductor hallucis m.; Abductor	73	74 75
29	minimi digiti m.; Flexor brevis digitorum m.; Tendon of flexor longus	76	77
30	digitorum m.; Musculus accessorius; Lumbricales mm.; Course, relations,	78	79 80
31	and branches of plantar aa.; Plantar nn.; Flexor brevis hallucis m.; Adduc-	81	82 83
32	tor hallucis m.; Flexor brevis minimi digiti m.; Transversalis pedis m.;	84	85
33	Interossei mm.; Ligg. of pelvis with the fifth lumbar vertebra; Ligg. sacrum	86	87 88
34	and coccyx; Sacro-iliac joint; Sacro-sciatic ligg.; Ligg. of pubic joint;	89	90 91
35	Ligg. of hip-joint; Ligg. of knee-joint; Ligg. of ankle-joint; Ligg. of foot.	92	93 94 95

DR. HUNTINGTON said that the cards were admirably designed and should form a most complete record of the student's work. He approved thoroughly of the principle which they implied, and congratulated Dr. Hewson on having worked out the satisfactory method which he employed. Dr. H. had formerly employed cards somewhat similar in his own dissecting room, though far less complete and much less compact and practicable. He found, however, a serious objection to their use in the time which the system demanded and deducted from the actual teaching hours of the demonstrator's staff. He had, therefore, of late devoted the entire time of the teaching force to actual instruction; the character and completeness of each student's practical work being noted and recorded by the demonstrator, he found that the test of a rigid practical examination on the cadaver answered every purpose of control.

DR. REISINGER said that while Dr. Hewson's forms were very good, he, Dr. R., advocated a single unfolded card as being easier to follow and punch. Instead of having the student keep his "Dissecting Card," Dr. R. had a "Card for Anatomical Work," which was signed by the demonstrator when the student presented his "Dissecting Card" punched, and passed an oral examination on his part. Dr. Hewson's "Anomaly Blank" was the most complete he had seen. Dr. R. expected to use a similar form next year. He heartily advocated this system of teaching practical anatomy, it being easier for student and teacher, by using the cards.

DR. WILDER said that the brain was regarded in these cards as merely one of the viscera; but he hoped that the time was coming when the organ would either be examined promptly or adequately preserved; when the significance of its features would be more generally admitted; and when the average medical student might be more fully qualified to recognize and describe them. The practical study of the brain should begin with that of the sheep and in the primary school; then the scholar in higher grades would be prepared for advanced instruction and for research.

A CASE OF PEROMELUS, WITH ABSENCE OF BOTH TIBIÆ.

Illustrated by the Specimens.

DR. C. A. HAMANN, CLEVELAND, OHIO.

These specimens were taken from an adult male, of whose history nothing can be learned.

In the undissected left lower extremity, it will be seen that the thigh lies almost parallel with the leg; the lower half of the thigh and the upper half of the leg are united by a thick fold, consisting of integument and muscular and tendinous tissue. The foot is placed in an exaggerated varus position, the external malleolus is very prominent; the patella is absent. Only one bone, the fibula, is present in the leg. There are five toes.

The bones of the right lower extremity have been macerated; only the lower half of the femur is present, so that the condition of the upper end of that bone can not be determined. The distal extremity of the femur has a rounded articular surface for the head of the fibula; on the inner side, at the position of the condyle, is an irregular osseous mass, about the size of an English walnut.

The fibula, which is the only bone present in the leg, is 10½ inches long, rather more curved and thicker than normal, its head articulates with the femur, and its distal extremity with the fused astragalus and os calcis. The astragalus is small, bears but little resemblance to the normal bone, and is united with the calcaneum. Of the other tarsal bones, only the cuboid and internal cuneiform are present; each of these articulates with two of the four metatarsal bones; the great toe is absent. The foot was placed in the same exaggerated varus position as the opposite one.

The first case of congenital absence of the tibia was described by Billroth, in 1861. Joachimsthal, in 1891, collected 31 cases; of these 23 were unilateral and 8 bilateral. Partial defects, in which the upper extremity of the tibia is present, are more common.

According to Waitz, in the majority of cases, the common characteristics, such as the flail-like knee-joint, great prominence of the external malleolus and the pes varus are met with. Absence of the patella is not constant. Heredity was not noted in the cases studied by Waitz; in his case there were scars from

amniotic adhesions. In a number of cases, as in mine, there have been seen bony masses at the lower end of the femur, to which were attached some of the muscles that normally pass to the upper end of the tibia, and this has led to the supposition that these bony masses represented the upper end of that bone.

The fore arms in my case afford examples of ectrodactyly. On the right side there are two digits, one of them being the thumb; a deep cleft extends between them to the lower end of the radius and ulna, giving the appearance which has been compared to the lobster's claw, *pince d'homard*.

I shall not detail to you the description of the muscles, arteries and nerves, but shall merely call attention to a musculo-tendinous loop, which arises anteriorly as a part of the flexor profundus digitorum, and at the wrist glides over a grooved, pulley-shaped surface at the lower extremity of the ulna. On the dorsal aspect, the muscular part of the roof arises as a part of the extensor communis digitorum; it is as though a tendon of the flex. profundus united, end to end, with a tendon of the extensor communis. Four carpal bones are present.

In the left upper extremity there are four digits, one of them being the thumb. There is also a cleft, extending to the carpus, between the two middle digits.

A similar musculo-tendinous loop exists as in the right upper extremity, though here it is double; the two anterior muscular bellies are part of the flexor profundus; the dorsal portions are part of the extensor communis. The intervening tendon of each of these digastric muscles glides over a grooved surface of one of the carpal bones.

Both radius and ulna are present in each upper extremity.

DR. HUNTINGTON said that considerable morphological interest attached to the pulley-like tendinous connection between the deep flexor and the extensor in the malformed upper extremities. He thought that it might be interpreted as representing in an extremely modified form the normal junction of the lumbrical portion of the deep flexor with the extensor tendon. The absence of the intermediate digits in both phalangeal and metacarpal elements would render this connection the only fixed point for the action of the ventral and dorsal muscular mass, which would explain the strength of the intermediate pulley-tendon.

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PROCEEDINGS
OF THE
TENTH ANNUAL SESSION
OF THE
Association
of
American Anatomists,

Held at Cornell University, Ithaca, N. Y., Dec. 28 to 30, 1897.

TO WHICH IS APPENDED A
LIST OF MEMBERS.



WASHINGTON, D. C.
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PROCEEDINGS OF THE TENTH ANNUAL SESSION.

The tenth annual session of the Association was held at Cornell University, Ithaca, N. Y., Tuesday to Thursday, December 28 to 30, 1897, in conjunction with the American Society of Naturalists and other affiliated societies.

Dr. Baker, president of the Association, presided at the meetings on the 28th and 29th, and Dr. Wilder, first vice-president, on the 30th. The following members were present at some time during the session: Baker, Blake, Ferris, Fish, Gage, Gerrish, Hopkins, Huntington, Hutchinson, Kerr, Lamb, Stowell, Stroud, Ward and Wilder; and in addition, Osborn and Minot attended one or more of the other societies; total, 17.

TUESDAY, DECEMBER 28TH.

McGraw Hall.

10 A. M. The Association was called to order by the president, Dr. Baker, who, after a few preliminary remarks, announced that Dr. Wilder would make an address concerning our deceased member, Dr. Harrison Allen.

Dr. Wilder then delivered an address; (see p. 12.) On motion, a vote of thanks was given Dr. Wilder, and the address ordered to be printed.

The Secretary reported that the following applications for active membership had been considered by the Executive Committee, and the names were recommended for election: Brown, Dorsey, Hopkins, Huber, Kerr, King, McDonough, Springle, Terry, Tuttle. On motion, the Secretary was directed to cast the ballot. (See list, *infra*.)

The report of the Secretary and Treasurer was read and accepted. The following are extracts therefrom:

"I would invite attention to the fact that I have on hand a number of copies of all the Proceedings except the fourth (the edition of which is exhausted), and would be pleased to send sets of them to libraries which desire them, if members will kindly give me the addresses.

"Since our last meeting we have lost six members; two by death, one by resignation, and three by reason of being dropped from the list because of non-payment of dues. Wm. Laurence Dana, A. B., M. D., of Portland, Maine, Instructor in Anatomy in the Portland School for Medical Instruction, died May 27, 1897. Dr. Harrison Allen, of Philadelphia, Emeritus Professor of Comparative Anatomy, and late Director of the Wistar Institute of Anatomy, University of Pennsylvania, died suddenly, November 14, 1897. Dr. Peter J. McCourt, of New York City, resigned December 14, 1897. The names of Drs. W. A. Campbell, of the University of Michigan, J. W. Hartigan, of the University of West Virginia, and C. L. Herrick, of Denison College, Granville, Ohio, have been dropped.

"I sent a brief note to the widow of Dr. Allen, expressing, for the Association generally and myself personally, regret at the death of her husband.

"There are now 109 members—105 active and 4 honorary. Since the last report I have received from dues for the current year, \$44.00; arrears for 1895-6, \$18.00; for 1894-5, \$16.00; for 1893-4, \$4.00; advance dues for 1897-8, \$4.00; and for 1898-9, \$2.00; total receipts, \$88.00; adding the balance on hand at last report, \$145.29, a total of \$233.29.

"I have expended for printing, which includes some stationery, \$147.41, for postage and remaining stationery, \$20.80; for copying, telegrams and express, \$2.40; total, \$170.61, leaving a balance on hand of \$62.68.

"The bill for our share of the expenses of the last Congress has not yet been presented for payment.

"There are 17 members in arrears for the current year; 4 for two years; and 4 for three years; a total sum of \$74.00.

"By the action of the last meeting, the yearly dues were increased to three dollars, to take effect next year.

"I intend to the provisional blank and circular in which Peculiarities of the Negro, a copy of each member with request for comment. Mr. Ward, of Rochester, is the only

member who has sent any reply to me; he has also sent two reports of examinations, and record."

Drs. Blake and Fish were appointed by the President a committee to audit the Treasurer's accounts.

No report was received from the Delegate or Alternate to the Executive Committee of the Congress of American Physicians and Surgeons.

Dr. Wilder, from the Committee on Anatomical Nomenclature, reported progress, and stated that a report on a certain number of terms would be submitted later in the session. Report accepted. The President appointed Dr. Huntington, in place of Dr. Allen, on the committee.

There was no report from the Committee on Table at Naples. The President appointed Dr. Theodore Gill to take Dr. Allen's place on this committee.

Dr. Lamb, from the Committee on Anatomical Peculiarities of the Negro, reported that no replies had been received from the members in reference to the circular and blanks sent to them, excepting from Mr. Ward, who had sent suggestions and two reports. The subject was discussed by Drs. Wilder, Baker, Huntington and Mr. Ward. The committee was continued with the understanding that some modifications should be made in the list and the circular, and copies then sent out for report of cases. Mr. Ward offered to measure skeletons sent to him for the purpose, and then return them.

The President appointed Drs. Gerrish and Huntington a Committee on the Nomination of Officers.

The following papers were read:

1. "A fluid for the retention of the natural colors of anatomical specimens." Illustrated by specimens. Dr. Fish. Discussed by Drs. Wilder, Huntington and Lamb.
2. "Mummification of small anatomical specimens." Illustrated by specimens. Dr. Fish. Discussed by Drs. Wilder and Huntington.
3. "Comparative anatomy and embryology as aids to the

teaching of human anatomy in the medical course." Illustrated by diagrams. Dr. Huntington. Discussed by Drs. Baker, Wilder and Fish and Mr. Ward.

4. Dr. Wilder showed an adult, healthy, living cat, lacking the left arm excepting the scapula, and having the heart apparently at the epigastrium.

The Association then adjourned.

Reassembled at 2 P. M.

The reading of papers was continued.

5. "Description of two Koutenay skeletons," and

6. "Two examples of unusual ossification of the first costal cartilages." By Prof. Dorsey. Read by title, in his absence.

7. "Relative diameters of the human thorax." By Dr. Hutchinson. Discussed by Drs. Huntington, Baker and Gerrish.

8. "Pre-Columbian syphilis." Illustrated by specimens. By Dr. Lamb.

9. "Relation of sex to the size of articular surfaces of long bones." By Dr. Hodge. Read by title in his absence.

10. Dr. Wilder showed a number of specimens of either unusual or especially instructive character. Discussed by Dr. Huntington.

11. "The membrana basilaris, membrana tectoria and nerve endings in the human ear." By Prof. Howard Ayers, University of Missouri. Read by Dr. Hopkins.

12. "Anus vulvalis." By Dr. Duncan. Read by title in his absence.

13. "Sebaceous glands in the mucous membrane of the mouth." By Drs. D. W. Montgomery and W. G. Hay, University of California. Read by Dr. Lamb, in the absence of

ches of the superior mesenteric artery to the m." By Dr. Dwight. Illustrated by photo-
" Dr. Lamb in the author's absence.

In the evening a reception was given by President Schurman, of Cornell University.

WEDNESDAY, DECEMBER 29TH.

The Association reassembled in McGraw Hall at 10 A. M.

The Executive Committee reported the following names for honorary membership, and, on motion, the Secretary cast the ballot for them :

1. Prof. Alexander Macalister, Cambridge, England.
2. Prof. Carl Gegenbaur, Heidelberg, Germany.
3. Prof. Wilhelm His, Leipzig, Germany.
4. Prof. Albert von Kölliker, Würzburg, Germany.
5. Prof. Mathias Duval, Paris, France.
6. Prof. L. Ranvier, Paris, France.

The Auditing Committee reported the Treasurer's accounts correct, and was discharged.

The Committee on the nomination of officers reported as follows :

For President,	. . . . .	Dr. B. G. Wilder.
For First Vice-President,	. . . . .	Dr. Geo. A. Piersol.
For Second Vice-President,	. . . . .	Dr. Wm. Keiller.
For Secretary and Treasurer,	. . . . .	Dr. D. S. Lamb.
For Delegate to the Executive Committee of Congress of American Physicians and Surgeons,	. . . . .	Dr. F. J. Brockway.
For Alternate,	. . . . .	Dr. R. W. Shufeldt.
For Member of the Executive Committee, in place of Dr. Huntington, term ex- pired,	. . . . .	Dr. F. J. Shepherd.

On motion, ballots were cast by the Secretary for all of these except Dr. Lamb, for whom Dr. Huntington cast the ballot.

The following papers were then read :

15. "Certain resemblances and peculiarities of the human brain." Illustrated by specimens and diagrams. By Dr. Wilder. Discussed by Drs. Huntington, Fish, Blake and Baker.

16. "The Ape Cerebellum." Illustrated by specimens and diagrams. By Dr. Stroud. Discussed by Dr. Huntington.

On motion, the Association adjourned over to 10 A. M., Thursday, in order to enable the members to attend the meeting of the American Society of Naturalists in the afternoon.

In the evening the annual banquet of the societies was held at Cascadilla Place.

THURSDAY, DECEMBER 30TH.

10.30 A. M. The Association reassembled in McGraw Hall. Dr. Wilder in the chair.

The following papers were read :

17. "The brain of the fur-seal, *Callorhinus ursinus*." By Dr. Fish. Discussed by Drs. Huntington and Wilder.

18. "The eparterial bronchial system of mammalia." Illustrated by diagrams. By Dr. Huntington. Discussed by Drs. Wilder and Hutchinson.

19. "The relation of the bronchi to the thoracic wall." Illustrated by photographs. By Dr. Blake. Discussed by Drs. Huntington and Wilder.

Dr. Huntington called attention to the international card bibliography in course of publication, urging better support.

Adjourned to meet at 3.30 P. M., at which hour the Association reassembled.

Dr. Wilder's request, Dr. Gerrish presided, while Dr. , the secretary of the Committee on Anatomical Notation, made a majority report (p. 27). The following members were present at the time: Blake, Gage, Gerrish, Huntington, Hutchinson, Kerr, Lamb, Stroud, Ward and Wilder.

The report was adopted without dissent, and, on motion, was referred to a special committee consisting of Drs. Baker and Wilder [the Chairman and Secretary of the Committee on Anatomical Nomenclature], and Dr. Lamb [Secretary-Treasurer of the Association], for publication and distribution; the publication to set forth, also, the objections of the minority of the Committee on Anatomical Nomenclature, and the comments thereon by the secretary of that committee; the special committee to take the wisest action, all things considered, in all matters of detail; and the Treasurer was authorized to expend the necessary amount. It was also understood that the publication should be as prompt as possible in order to be of service to the "Committee of Revision" of the *Anatomische Gesellschaft*, prior to its meeting at Kiel, April 20, 1898.

A vote of thanks was passed to the University authorities for courtesies.

The following papers were then read :

20. "On the relation of the ureters in the cat to the great veins; with variations." Illustrated by specimens and diagrams. By Prof. Gage. Discussed by Dr. Huntington.

21. "Notes on the appendix." Illustrated by specimens. By Dr. Stroud. Discussed by Dr. Huntington.

22. "Notes on the fish fauna of Cayuga lake." Illustrated by charts and specimens. By Mr. H. A. Surface, Fellow in Cornell University.

23. "A skin-heart." By Dr. Hutchinson. Read by title.

24. "A cranio-mandibular index." Illustrated by diagrams. By Mr. Ward. Discussed by Prof. Gage.

The Association then, about 6.30 P. M., adjourned *sine die*.

A brief notice of the proceedings appeared in *Science*, March 4th, p. 311; *Boston Med. and Surg. Jour.*, March 3d, p. 208; *Jour. Amer. Med. Ass.*, March 12th, p. 61; and New York *Med. Record*, March 19th, p. 417; perhaps also in other journals which have not yet come to the eye of the secretary.

CONSTITUTION.

SECTION 1. The name of the society shall be the "ASSOCIATION OF AMERICAN ANATOMISTS."

SEC. 2. The Association shall have for its object the advancement of the anatomical sciences.

SEC. 3. The officers of the Association shall consist of a President, two Vice Presidents, and a Secretary, who shall also act as Treasurer.

SEC. 4. The officers shall be elected by ballot every two years.

SEC. 5. The management of the affairs of the Association shall be delegated to an Executive Committee, consisting of its President, Secretary and three other members.

SEC. 6. One member of the Executive Committee shall be elected annually.

SEC. 7. The Association shall meet annually, the time and place to be determined by the Executive Committee.

SEC. 8. Candidates shall be proposed in writing to the Executive Committee by a member. Each proposal shall be made at or before the first session of any regular meeting of the Association. The proposal shall state the official position or occupation of the candidate and the character of his investigations. The election shall take place by ballot in open meeting, a two-thirds vote being necessary. Honorary members may be elected from those, not Americans, who have distinguished themselves in anatomical research.

SEC. 9. The annual dues shall be three dollars. A member in arrears for dues for two years shall be dropped by the Secretary at the next succeeding meeting of the Association, but may be restored on payment of arrears, at the discretion of the Executive Committee.

SEC. 10. The rulings of the Chairman shall be in accordance with "Robert's Rules of Order."

SEC. 11. Five members shall constitute a quorum for the transaction of business.

OFFICERS FOR THE YEAR 1897-98.

DR. B. G. WILDER, of Ithaca, N. Y., - - - - President.
 DR. GEO. A. PIERSOL, of Philadelphia, Pa., - - First Vice President.
 DR. WM. KEILLER, of Galveston, Tex., - Second Vice President.
 DR. D. S. LAMB, of Washington, D. C., - - Secretary and Treasurer.

**DELEGATE TO EXECUTIVE COMMITTEE OF CONGRESS OF AMERICAN
 PHYSICIANS AND SURGEONS.**

DR. F. J. BROCKWAY, of New York City.

ALTERNATE.

DR. R. W. SHUFELDT, of Washington, D. C.

EXECUTIVE COMMITTEE.

DR. ARTHUR D. BEVAN, of Chicago, Ill.
 DR. F. H. GERRISH, of Portland, Me.
 DR. F. J. SHEPHERD, of Montreal, Can.
and the
 PRESIDENT and SECRETARY, *ex officio*.

COMMITTEE ON ANATOMICAL NOMENCLATURE.

DR. FRANK BAKER, of Washington, D. C., *Chairman*.
 DR. THOMAS DWIGHT, of Boston, Mass.
 DR. F. H. GERRISH, of Portland, Me.
 DR. GEO. S. HUNTINGTON, of New York City.
 DR. BURT G. WILDER, of Ithaca, N. Y., *Secretary*.

**COMMITTEE ON CIRCULAR IN REGARD TO ANATOMICAL PECULIARITIES
 OF THE NEGRO.**

DR. D. S. LAMB, of Washington, D. C.
 DR. FRANK BAKER, of Washington, D. C.
 DR. D. K. SHUTE, of Washington, D. C.

MEMBERS OF SMITHSONIAN COMMITTEE ON THE TABLE AT NAPLES.

DR. GEO. S. HUNTINGTON, of New York City.
 DR. THEODORE GILL, of Washington, D. C.

HARRISON ALLEN.*

In Harrison Allen this Association has lost one of its founders and most active members and its second president; science has lost a devotee; medicine has lost a specialist of high rank; the community has lost a man of lofty character and broad culture; there are doubtless others beside myself upon whom the announcement of his death on the 14th of November fell with the shock of personal bereavement, great and irreparable. During the present week Dr. Allen and his family were to have been my guests. What contrast could be greater than between the joys anticipated and the sad reality of the tribute which, at the request of our president, is now offered to the memory of our collaborator and friend?

Harrison Allen was born in Philadelphia, April 17, 1841. His parents were Samuel Allen and Elizabeth Justice Thomas. His ancestors accompanied William Penn, and on his father's side he was descended from Nicholas Waln, distinguished in the early history of Philadelphia. As a boy, Harrison was interested in Natural History, and at or before sixteen he went on an extended walking and camping trip in western Pennsylvania with associates of like tastes, amongst whom was George Horn, also lately deceased. Although he would have preferred pure science, financial considerations led him to study medicine, including dentistry.

After gaining his M. D. at the University of Pennsylvania, he was on duty for a time at the Blockley Hospital, in his native city. On the 31st of January, 1862, he was appointed Acting Assistant Surgeon U. S. A., and Assistant Surgeon, July 30, 1862, serving in hospitals and in the defences of Washington until the acceptance of his resignation, December 8, 1865. He then ranked as Brevet Major. It was during the winter of 1862-63 that I first made his acquaintance at a meeting of the Potomac Side Naturalists' Club, attended also by Elliott Coues, Theodore Gill and others. Our army service did not throw us together, and I little thought then how dear Dr. Allen was to become to me in later years; for ten

* This address was printed in *Science*, for February 25, 1898, with a portrait, but without the Appendix and Bibliography.

summers, indeed, we have been near neighbors at Nantucket, and I have been looking forward to the time when less pressure of work would permit me to enjoy his society more fully.

Dr. Allen now practised his profession with assiduity and success. His dental education facilitated specialization in respect to the air passages, and in 1880 he was president of the American Laryngological Association. Of his strictly medical and surgical publications (numbering about fifty) most relate more or less directly to his specialty.

But while he earned his living by medicine, it was in science that he lived, and it is this side of his career that interests us more as members of this Association. The subject of his thesis at graduation was "Entozoa Hominis," probably suggested by his beloved teacher, Joseph Leidy. His first scientific paper appeared in July, 1861, in the Proceedings of the Academy of Natural Sciences, and treated of certain bats brought from Africa by the explorer Du Chaillu; besides the two editions of his monograph of the bats of North America, published by the Smithsonian Institution in 1864 and 1893, respectively, to the same highly specialized mammals were devoted thirty of his scientific papers; just before his death he completed articles on the Glossophaginæ and on the genus *Ectophylla*. Yet, while remaining throughout life true to his first scientific love, Dr. Allen published valuable notes or memoirs upon many other subjects, notably the joints, the muscles, locomotion and crania; indeed, the week before he died he handed over to the Wagner Institute of Science a study of the skulls from the Hawaiian Islands, much more elaborate than the previous one of the Florida crania. To him also was appropriately conceded the privilege of dissecting and describing the remarkable Siamese Twins.

Dr. Allen was emphatically, and in a double sense, a *fine* anatomist. So far as I know he seldom used the compound microscope, and availed himself little of the multifarious devices, chemical and mechanical, of modern histology. But his dissections of delicate organs were simply exquisite, demanding the most perfect training of hand and eye. Yet his habitual devotion to creatures of minor size did not deter him, during the past summer, from offering to superintend, in behalf of the United States National Museum, the preparation of the skeleton of a sperm whale that came ashore near his seaside home.

Besides the papers and volumes already mentioned, Dr.

Allen published, in 1869, "Outlines of Comparative Anatomy and Medical Zoölogy," and in 1884 completed an elaborate treatise on Human Anatomy, wherein is laid stress upon the medical and surgical bearing of the facts of human structure. Finally, and rightly to be mentioned in exemplification of his broad culture and sympathies, here is a discussion of "The Life Form in Art," and here an address on "Poetry and Science," delivered before a Browning Society. Nor must it be forgotten that music had always charms for our friend, and that he was an admirable player upon the flute.

But Dr. Allen was not merely a successful practitioner and eminent investigator; he was also a teacher. In the University of Pennsylvania he was professor of zoölogy and comparative anatomy from 1865 to 1876; professor of physiology from 1878 to 1885; emeritus professor of physiology to 1891; professor of comparative anatomy and zoölogy, 1891-96. He had been connected with his *alma mater* for more than thirty years, a period exceeded only in the case of five other professors. Dr. Allen was an active or corresponding member of numerous scientific societies in this and other countries, and was President of the American Society of Naturalists in 1887 and in 1888. A large part of his work was done at the Academy of Natural Sciences and published in its *Proceedings*.

The climax of Dr. Allen's useful and honorable career was reached in 1891. He was then fifty years of age, and for half that time had been connected with the University. In 1891 he became Professor of Comparative Anatomy and Zoölogy; President of the Contemporary Club of Philadelphia; Curator of the newly-established Wistar Institute of Anatomy; President of the Anthropometric Society; then, too, he succeeded Professor Leidy in the presidency of this Association, holding office for one term, or two years. No such combination of honors and responsibilities within a single year is known to me. During 1891 he published fourteen separate papers or addresses.

On the 29th of December, 1869, Dr. Allen married Miss Julia Colton; she survives him, together with a daughter, Dorothea and a son who bears his father's name, and who has already begun the study of the profession in which his father gained such eminence. Dr. Allen's private collections of arts and other specimens were bequeathed to the Academy of Natural Sciences. As a member of the Anthropometric Society he directed that his brain should be entrusted to that

organization. His body was cremated. The autopsy revealed the cause of his death as heart-failure, due to fatty degeneration; he had of late years also been subject to rheumatism.*

It is idle to speculate as to what Dr. Allen might have achieved in pure science had his health been more robust, his nature more aggressive, and his time more nearly at his own disposal. For, in considering the extent and value of his publications, we must take into account two potent factors in his life; first, he was in active practice; secondly, he was eminently conscientious and recognized to the full that his patients were entitled to the best that he could do. Gratuitous attendance upon those unable to pay is so general in the medical profession that it would be invidious in me to more than record my personal knowledge of cases in which Dr. Allen's skill was exercised at his serious personal inconvenience and when in need of rest.

Whether due to his Quaker ancestry or to principle, Dr. Allen was non-combative, and sometimes suffered injustice rather than engage in controversy. But in the advocacy of a principle he could be tenacious and even aggressive. Twenty-one years ago, during Huxley's visit to this country, an address on Medical Education was interpreted by Dr. Allen as controverting his doctrine as to the inclusion of Comparative Anatomy in a medical course. He promptly protested in a daily journal and discussed the subject with marked emphasis in a paper before the American Association for the Advancement of Science, in 1880. In view of the enormous prestige

NOTE.—In the address as delivered and as published in *Science*, it was erroneously stated that Dr. Allen held office for two terms or four years. As a matter of fact, he was elected president in September, 1891, and served until June, 1894.

ability, activity and enterprise."

In this package are all my letters from Dr. Allen, more than forty in number. The first is dated December 2, 1867. As

* Early in May, 1897, Dr. Allen underwent an operation for appendicitis, but apparently recovered therefrom.

may be imagined, many of the more recent discuss the formation, progress and prospects of this Association. The second letter so clearly exhibits his modesty, his unselfishness, and his loyalty to his friends, that I quote a few sentences. . . . *

I could occupy much time with details of my dear friend's life and nature, but content myself with enumerating what seem to me rare combinations of characteristics. An ardent naturalist, and daily handling specimens variously preserved, he was fastidiously neat in person and apparel. Simple in his tastes, yet conforming to the customs of the most conventional of cities. Rigid in the performance of duty, yet considerate of the shortcomings of others. Dignified, yet not haughty. Affable, yet insisting upon the respect due to scholarship and culture. A delightful conversationalist, yet an equally attentive listener. Mirthful, yet never condescending to buffoonery. Sociable in the company of men, yet neither uttering nor tolerating what might not be said before the other sex. Emulous of all excellence, yet never envious of those who surpassed him in special directions. "Let us cherish his memory and profit by his example." Nay, perhaps, take warning therefrom. For, humanly speaking, had he worked less incessantly, and especially less far into the night, he might be with us to-day.

Intimate as we were, and often as we conversed upon matters involving the duties of human beings toward one another, no theologic point was ever mentioned between us, and I am absolutely ignorant of the nature of his religious convictions. But whatever may have been his belief, and whatever may be our own, I feel that no violence is done by the repetition of three verses of the twenty-fourth Psalm that have arisen in my memory repeatedly during the past six weeks while reflecting upon Harrison Allen :

"Who shall ascend into the hill of the Lord or who shall stand in his holy place? He that hath clean hands and a pure heart; who hath not lifted up his soul unto vanity nor sworn deceitfully. He shall receive the blessing from the Lord, and righteousness from the God of his salvation."

* There was then vacant a high position for which he had been strongly recommended by one who had declined it. He wrote to ask if I were a candidate, implying that, if so, he would withdraw. Under date of December 16, 1896, he wrote: "I shall gladly be your disciple in all matters of nomenclature."

APPENDIX.

Permission is given to add the following extracts from letters of two friends of Dr. Allen, Mr. Cyrus Elder, of Philadelphia, and Mr. Lorin L. Dame, of Medford, Mass., a teacher and botanist, in whose company Dr. Allen explored many parts of Nantucket:

From Mr. Elder.

I think Dr. Allen's distinguishing trait was simplicity, a gracious inheritance from his Quaker ancestors, that became finer through his devotion to scientific research, which was a perpetual seeking after the truth. All pretense was foreign to him. The friends he admitted felt very near to him, for they knew that they were hospitably at home with the man himself. Living in the most conventional of all cities, where the "best people" are always under the dread of speaking to the wrong person, he conformed to its usages, with now and then an amused and amusing protest. Personally he had no standard but merit, no respect for anything but real worth, and he was tolerant of everything but intolerance.

Dr. Allen was pure in thought and speech. All his tastes were refined. He was a lover of poetry, art and music. As a narrator he had a charming style and a quaint and delicate fancy. If science had not drawn him by such strong cords he would have made a name in literature.

I think he got a great deal of enjoyment out of life, for he took things simply, and found the good in them, and this invited the best, and he paid it all back by giving the best.

The writer has a pleasant recollection of "roughing it" with the Doctor, in a traveling and camping expedition, an outing of several weeks, in which the Alleghany Mountains were crossed twice by different routes, and ten or more camps were made. There were plenty of incidents to try the temper—the labors of making and breaking camp were onerous, meals were irregular, the rain came at the wrong moment, and the slope of the ground in the floor of the tent, or the rocks and roots which cumbered it, made the bed for sleeping anything but restful; but the Doctor took everything that came with cheerfulness. The cook and guide of the party knew nothing of college professors, but he knew a man when he saw him, and he pronounced the Doctor "a good fellow." When pools

were encountered, the guide volunteered his aid in capturing infusoria, and the "hell-bender" became to him an object of scientific interest.

One may be a clubable man with merely superficial sociability, but to be a "campable" man requires much more, and this sort of intimate association, day after day, among the mountains and woods and streams, revealed the Doctor's charming companionableness. It was an experience that, alas, could not be repeated, and now, of the six who constituted the party, there are but three survivors.

There has been prompt and full recognition of the Doctor's great achievements and the worthiness of his work. I hope his biographer will be able to tell how he fitted himself for this large usefulness. I think it will be an inspiring history of the triumph of genius in overcoming all obstacles and rising to its appointed place, and of such instances it is profitable for the world to hear.

From Mr. Dame.

He was alive to every aspect of nature, inquisitive as to the behavior of plants and animals, keenly observant of the changing forms of cloud and sea. I well remember the scores of pondlets, bits of marsh, fossil banks, and slices of New Jersey bodily moved northward, that we examined together, and henceforth they will always be associated with him.

I am sorry that his address at the teachers' convention last summer was not written out. I never realized fully before the breadth of his observation and the firm grasp he had of his subject. His topic really was the Physiography and Botany of Nantucket. He treated both parts in a masterly way, and closely held the attention of the audience. With characteristic modesty he told his hearers that, as far as botany was concerned, he had learned it all from me. As far as the mere botanical facts were concerned, he was measurably correct in that statement, but the arrangement and grouping of these facts, the theories built upon them, and the luminous exposition of his views, were all his own.

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* The following abbreviations are employed: *A. N. S.*, for *Proceedings of the Philadelphia Academy of Natural Sciences*; *A. J. M. S.*, for *American Journal of the Medical Sciences*; *U. S. N. M.*, for *Proceedings of the United States National Museum*. Notwithstanding valuable assistance from Mr. Harrison Allen, Jr., and from the secretary of the Association, this list is probably imperfect. Corrections and the items needed will be gratefully received by the writer.

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For an analysis of Dr. Allen's work in Anthropology and Zoölogy, and some additional biographic details, see the articles by D. G. Brinton, N. Rhoads and E. J. Nolan, respectively, in the A. N. S. for December 1897.

REPORT OF THE MAJORITY OF THE COMMITTEE ON ANATOMICAL
NOMENCLATURE, ADOPTED DECEMBER 30, 1897.

§ 1. The present report is confined to the names of parts of the central nervous system, including the meninges and blood-vessels. It is based upon the following:

A. The reports of this committee that were adopted by the Association in 1889 and 1895, respectively, viz.:

"A Committee on Anatomical Nomenclature was appointed [Dec. 27, 1889] consisting of Drs. Leidy [*Chairman*], Allen, Baker, Stowell and Wilder [*Secretary*]. The Committee made the following Preliminary Report [Dec. 28].

"The committee recommend:

"1. That the adjectives **dorsal** and **ventral** be employed in place of *posterior* and *anterior* as commonly used in human anatomy, and in place of *upper* and *lower* as sometimes used in comparative anatomy.

"2. That the cornua of the spinal cord, and the spinal nerve-roots, be designated as **dorsal** and **ventral** rather than as *posterior* and *anterior*.

"3. That the costiferous vertebræ be called **thoracic** rather than *dorsal*.

"4. That the *hippocampus minor* be called **calcar**; the *hippocampus major*, **hippocampus**; the *pons Varolii*, **pons**; the *insula Reilii*, **insula**; *pia mater* and *dura mater*, respectively **pia** and **dura**.

"Thomas Dwight [present at the meeting] was added to the committee.

"The committee desire frank and full expressions of opinion from scientific and medical journals, from individuals who receive copies, and from any others who are interested in the subject."—Extract from "History, etc., for the years 1888, 1889, 1890," Washington D. C., 1891, p. 5.

The Committee on Anatomical Nomenclature made the following report:

"The committee report general progress in the consideration of the complex subject entrusted to them, and express the opinion that substantial improvement will result from the work of the Committee of the *Anatomische Gesellschaft*.

"Your committee recommend to anatomists that, other things being equal, terms consisting of a single word each be employed rather than terms of two or more words.

"(Signed,)

HARRISON ALLEN, *Chairman*,
THOMAS DWIGHT,
FRANK BAKER,
FREDERIC H. GERRISH,
BURT G. WILDER, *Secretary*."

The report was discussed by Dr. Wilder and adopted, including its recommendation.—From the "*Proceedings of the Eighth Annual Session, Dec. 27 and 28, 1895*," pp. 4 and 5.

B. The similar reports of the Committee on Anatomical Nomenclature with Special Reference to the Brain,* that were adopted by the American Association for the Advancement of Science in 1889 and 1890, and published in its *Proceedings*, pp. 26 and 20, respectively.

C. The preliminary contribution of the American Branch of the International Committee on Biological Nomenclature of the American Association for the Advancement of Science,† which was adopted by that body Aug. 23, 1892, and published in its *Proceedings*, p. 231.‡

The main features of this report may be summarized as follows:

* The committee comprised H. Allen, F. Baker, Henry F. Osborn, T. B. Stowell, and B. G. Wilder, *chairman*.

† The members are George L. Goodale, Ph. D., professor of natural history at Harvard University, chairman; John M. Coulter, LL. D., president of the University of Indiana; Theodore Gill, Ph. D., Smithsonian Institution; William Minot, Ph. D., professor of embryology in Harvard University; H. H. Henshaw, Ph. D., professor of histology and embryology in Harvard University, secretary.

‡ The members were distributed to biologists of all nationalities, and may be found in the *Proceedings*, p. 231.

(a) "Terms relating to position and direction [toponyms] should be intrinsic rather than extrinsic; that is, should refer to the organism itself rather than to the external world."

(b) "So far as possible, terms should be single, designatory words [mononyms] rather than descriptive phrases."

(c) "Terms derived from the names of persons [eponyms] should be avoided."

(a) "Each term should have a Latin [international] form."

(e) "Each term should have also a [national] form in accordance with the genius of each modern language, *e.g.*, a paronym of the original Latin form."

(f) "The report gives due recognition of the labors of other committees and of individuals."

D. The report of the Committee on Neuronymy* of the American Neurological Association adopted June 5, 1896, and published in the *Transactions*, pp. 197, 198. This included the reports adopted by this Association above mentioned (A) together with the following specific recommendations:

"That the following be employed rather than their various synonyms: hypophysis, epiphysis, (for conarium and corpus pineale), chiasma, oblongata, lemniscus, monticulus, tegmentum, pulvinar, falx, tentorium, thalamus, callosum, striatum, dentatum, mesencephalon, pallium, oliva, clava, operculum, fissura centralis (for f. Rolando, etc.), f. calcarina, f. collateralis, f. hippocampi, cuneus, praecuneus, claustrum, fornix, infundibulum, vermis."

E. The List of *Termini Neurologici Generales et Proprii* adopted by the *Anatomische Gesellschaft* in 1895 and pub-

*The committee was appointed by the president of the Association, at the regular meeting in New York City, June 20, 1884. One of the most interested of the original members, Dr. W. R. Birdsall, has since died. It now comprises Henry H. Donaldson, Ph. D., professor of neurology, Chicago University; Landon Carter Gray, M. D., professor of nervous and mental diseases, New York Polyclinic; Charles K. Mills, M. D., professor of diseases of the mind and nervous system in the Philadelphia Polyclinic; Edward C. Seguin, M. D. (since deceased), professor of diseases of the mind and nervous system in the Medical Department of Columbia University; Edward C. Spitzka, M. D., formerly professor of the anatomy and physiology of the nervous system in the Post-graduate Medical School of New York City; and B. G. Wilder, *chairman*.

lished (with comments by Professor His) as part of the B. N. A. (Basel Nomina anatomica).*

F. The Preliminary Lists of Synonyms, with Commentaries and Discussions, prepared by Prof. Wm. Krause, secretary of the *Nomenclatur Commission* of the *Gesellschaft* between 1891 and 1895, and covering nearly one thousand pages; a copy of each fasciculus was courteously sent as soon as issued by Dr. Krause to a member of this committee.

G. The "Table of Neural Terms" preferred by the secretary of this committee published in his "Neural Terms, International and National," (*Journal of Comparative Neurology*, VI, December, 1896, 216-352), pp. 302-319, in columns parallel with those of the B. N. A.

Since copies of this entire paper, or of the "Table", have been sent to members of this Association and of the *Nomenclatur Commission* of the *Gesellschaft*, it will be referred to somewhat freely in the present report.

H. The discussion of the general subject and of specific terms in the publications enumerated in the Bibliography of "Neural Terms," pp. 340-352.

I. The article by C. L. and C. J. Herrick, "Inquiries regarding current tendencies in neurological nomenclature," *Jour. Comp. Neurology*, VII, 162-168, December, 1897.

J. The list of names of parts of the central nervous system prepared by the secretary of this committee as collaborator upon Foster's *Encyclopædic Medical Dictionary* (1888-1894). In 1888 the total was 10,500, distributed as follows, in round

* Die anatomische Nomenclatur. Nomina anatomica, Verzeichniss der von der Anatomischen Gesellschaft auf ihrer IX. Versammlung in Basel angenommenen von Wilhelm His Namen. Eingeleitet und im Einverständniss mit dem Redactionsausschuss erläutert. *Archiv für Anatomie und Physiologie*, Anat. Abth., Supplement Band, 1895. O., pp. 180; 27 figs., 2 plates, 1895.

numbers: Latin 3,100; English, 1,800; French, 1,800; Italian and Spanish, 900; German, 2,900.

§ 2. We are not unmindful of the objections to any interference with existing terms, especially such as are sanctioned by the *Anatomische Gesellschaft*. Yet a reasonable presumption in favor of our recommendations may be based upon the following considerations:

1. Our experience as teachers of anatomy, human and comparative, aggregates 63 years; hence the abstract zeal for reform has been balanced by contact with actual conditions.

2. The periods during which our attention has been largely directed toward the desirability and the practicability of improvement in nomenclature aggregate 50 years.

3. The terminologic principles accepted by the *Anatomische Gesellschaft* in 1895 had all been formulated, published and practised for varying periods prior to that date by one or more of us.

4. Of the specific neural terms adopted by the *Gesellschaft* many were systematically employed by one or more of us during the period between 1880 and 1895; *e. g.*, *gyrus* for *convolutio*; *hippocampus* for *hippocampus major*, etc.; *hypophysis* for *glandula pituitaria*; *oliva* for *corpus olivare*; *clava* for *processus clavatus*; *centralis* for *Rolando*; *pons* and *insula* for *pons Varolii* and *insula Reillii*; *diencephalon* for *thalamencephalon*.

5. With few exceptions the terms herein recommended had been adopted by each of us individually, and prior to the conference at which joint action was taken.

§ 3. Two features of this report should be noted, differentiating it, the one (A) from the report adopted by the *Anatomische Gesellschaft* in 1895, the other (B) from nearly all previous reports of American committees upon this subject.

A. The B. N. A. includes about 540 neural terms. Including those that were adopted at previous meetings of this Association, the present report embraces only 375.

In offering only a partial list we have followed the precedents of all the American committees; indeed we believe the B. N. A. would have been more acceptable had it either omitted certain terms, or included alternatives in some cases, or indicated the existence of degrees in the positiveness of indorsement. It seems to us improbable that all the members of the *Anatomische Gesellschaft* really anticipate the retention of, *e. g.*, "manubrium sterni," "corpus sterni" and "processus xiphoideus" for *praesternum*, *mesosternum* and *xiphisternum*, respectively; of "squama occipitalis" for (*os*) *supraoccipitale*; of "arcus zygomaticus" for *zygoma*; of "latissimus dorsi," "biceps brachii" and "triceps brachii" for *latissimus*, *biceps* and *triceps* respectively; of "processus vermiformis" for *appendix*; of "substantia corticalis" for *cortex*; of "vena cava superior" and "vena cava inferior," "~~radix anterior~~" and "~~radix posterior~~," for terms not dependent for appropriateness upon the erect attitude of the human body.

B. So far as we know, with but a single exception, all previous American reports upon anatomical nomenclature have been unanimous.*

§ 4. Our reluctance to present merely a majority report has been overborne by the following considerations:

a. Since 1880 the preference of a constantly increasing number of American anatomists for a simplified encephalic nomenclature has been more or less distinctly indicated.

b. The reports that were unanimously adopted by this Association in 1889 and 1895 clearly indicated certain directions along which simplification might be attempted.

c. Some of the additional terms adopted by the American

* In 1887, at the meeting of the American Association for the Advancement of Science, there were present only two out of the five members of the Comical Nomenclature with Special Reference to that of the Port was signed by them alone. In this connection it may be stated in the *Ergänzungsheft*, 1895, p. 162, of the eighteen *Nomenclatur Commission* there were present at Basel only *rural Terms*, p. 260.

Neurological Association in 1896 encouraged belief in the acceptability of a simplified terminology to practitioners of medicine.

d. At the meetings in Philadelphia, December, 1895, and in Washington, May, 1897, the majority of this committee were prepared to make a considerable number of specific recommendations. Action was deferred, in 1895 in accordance with the wish of the minority; in 1897 because one of the minority was absent,* and the other had failed to indicate in advance his preferences respecting terms upon the printed list provided for the purpose.

e. At the present meeting the vacancy caused by the death of Dr. Allen was filled by the appointment of Dr. Huntington; Dr. Dwight was again absent; Dr. Baker attended only the first of the three conferences of the committee, and was not in town during the day when this report was presented.

f. In accordance with the provision of the *Anatomische Gesellschaft* for a triennial revision of the B. N. A. (*Anat. Anzeiger, Ergänzungsheft*, 1895, 161), unless action were taken at this meeting the recommendations of this Association would probably not be considered by the *Gesellschaft* until 1901.

g. While we regard any action of this Association at a regular meeting as worthy of careful attention by the absent members and by other anatomists, and while we hope the terms recommended may be favorably considered and given a fair trial in research and instruction, we are far from holding that such action is binding upon individuals or that it commits the Association irrevocably to the position now taken.

h. Under all the circumstances the majority of the committee have decided to submit the present report, together with the recommendation that with it be published the views of the minority and the comments thereon by the secretary of the committee.

* Dr. Allen was also absent but had already, under date of Dec. 16, 1896, declared his adherence to the views of the secretary.

§ 5. The terms were considered and adopted under four categories, *viz* :

A. Such as occur in both the B. N. A. and in the list of the secretary (*i. e.*, in both the first and the second columns of the "Table of Neural Terms"), and are in common use, as indicated by the word *General* in the fourth column. These are twenty-three in number, *viz* : Nervus ; ganglion ; ramus communicans ; ramus anastomoticus ; nervus cutaneus ; plexus nervorum spinalium ; lobi cerebri ; lobus frontalis ; lobus temporalis ; lobus occipitalis ; lobus parietalis ; eminentia collateralis ; fornix ; tapetum ; putamen ; claustrum ; pulvinar ; tractus opticus ; mesencephalon ;* cerebellum ; decussatio pyramidum ; arteria basilaris ; arteria vertebralis.

§ 6. B. Such other terms as occur in both Lists, but with the understanding that in some cases there is a difference in the significance attached to them. They are seventy-eight in number, *viz* : Rhinencephalon ;† area parolfactoria ; bulbus olfactorius ; gyrus subcallosus ; lobus olfactorius ; tractus olfactorius ; trigonum olfactorium ; pallium ; impressio petrosa ; insula ; gyri insulae ; gyrus longus insulae ; gyri breves insulae ; polus frontalis ; gyri orbitales ; polus temporalis ; fissura collateralis ; polus occipitalis ; gyrus angularis ; fissura hippocampi ; uncus ; praecuneus ; fissura calcarina ; cuneus ; trigonum collaterale ; hippocampus ; digitationes hippocampi ; striae transversae ; cingulum ; fasciculus uncinatus ; diencephalon ;‡ stria medullaris [thalami] ; infundibulum ; hypophysis ; radix lateralis [tractus optici] ; recessus opticus ; recessus infundibuli ; fasciculus retroflexus ; decussationes tegmentorum ; lemniscus lateralis [mesencephali] ; sulcus lateralis [mesencephali] ; tegmentum ; vermis ; monticulus ; culmen ; declive ; pyramis ; uvula ; nodulus ; flocculus ;

* signification of *mesencephalon* will be considered in connection with other segmental names, § 25, constituting practically a fifth category.

† These segmental names will be considered in § 25.

fastigium; pons; sulcus basilaris; rhaphe*; lemniscus; laminae medullares; ala cinerea; area acustica; locus caeruleus; obex; oliva; funiculus lateralis; funiculus cuneatus; tuberculum cinereum; funiculus gracilis; clava; intumescencia cervicalis; intumescencia lumbalis; incisura tentorii; cavum epidurale; cavum subdurale; cavum subarachnoidale*; cisterna chiasmatis; ligamentum denticulatum; rami spinales; vena basalis; vena choroidea†; sinus sphenoparietalis.

§ 7. C. The fifteen terms which, notwithstanding more or less difference from the corresponding terms in the B. N. A., were adopted by the American Neurological Association in 1896 (§ 1, D). Five of them had already been adopted by this Association in 1889 (§ 1, A) and by the Amer. Assoc. for the Adv. of Science in 1890 (§ 1, B). In the following Table these adoptions are indicated by the abbreviations, A. A. A., '89 and A. A. A. S., '90.

TABLE I.

A.N.A. and A.A.A.	B.N.A.	Other Synonyms.
1. CALCAR (A.A.A., '89; A.A.A. S., '90)	Calcar avis	Hippocampus minor; Eminencia digitalis; Unguis
2. CALLOSUM	Corpus callosum	Trabs cerebri
3. CHIASMA	Chiasma opticum	Chiasma nervorum opticorum; Commissura optica
4. CORNU DORSALE (A.A.A., '89; A.A.A.S., '90)	Columna posterior	Cornu posterius
5. CORNU VENTRALE (A.A.A., '89; A.A.A.S., '90)	Columna anterior	Cornu anterius
6. DENTATUM	Nucleus dentatus	Corpus dentatum cerebelli
7. DURA (A.A.A., '89; A.A.A.S., '90)	Dura mater	
8. EPIPHYSIS	Corpus pineale	Conarium; Glandula pinealis; Epiphysis cerebri
9. FALX	Falx cerebri	Falx major; Processus falciformis
10. FISSURA CENTRALIS	Sulcus centralis	Fissura Rolandica; Sulcus postero-parietalis
11. OBLONGATA	Medulla oblongata	Bulbus rhachidicus
12. OPERCULUM	Operculum (pars parietalis)	Operculum parietale
13. PIA (A.A.A., '89; A.A.A.S., '90)	Pia mater	
14. STRIATUM	Corpus striatum	Ganglion cerebri anterius
15. TENTORIUM	Tentorium cerebelli	

* In the B. N. A. *choroidea* is spelled "*chorioidea*", and *subarachnoidale*, "*subarachnoideale*", the omission of the *e* in "*cisternae subarachnoidales*" (as reproduced in Table IV, 209) being probably an oversight. Whether or not the vowels in question are to be retained may be determined hereafter. We have retained the first *h* in *rhaphe* as a Latinized Greek word although it is omitted in the B. N. A., and might well be when the word is regarded as English.

§ 8. With six of the terms in the above Table (*cornu dorsale*; *cornu ventrale*; *dentatum*; *epiphysis*; *fissura centralis*, and *operculum*) the differences from the B. N. A. are more or less radical. But with nine there is merely the question of the retention of words which we regard as superfluous, and which are here placed in parentheses. *Calcar (avis)*; (*Corpus callosum*); *Chiasma (opticum)*; *Dura (mater)*; *Falx (cerebri)*; (*Medulla oblongata*); *Pia (mater)*; (*Corpus striatum*); *Tentorium (cerebelli)*.

§ 9. *Calcar*, *pia* and *dura* have already been recommended by all four American committees and by the three associations represented by them. They also seem to us to merit retention in accordance with the principle adopted by the same associations that, "other things being equal, terms consisting of a single word each be preferred to terms consisting of two or more words." No instance of misapprehension from the use of these mononyms has come to our knowledge.

It is true that *calcar* has also been applied occasionally to two other parts, *viz.*: the calcaneum (os calcis) and the styloid process of the temporal bone. But (a) neither of these uses is sanctioned by the B. N. A., and (b) even if they were, the context would infallibly avert misapprehension.

Furthermore, the sufficiency of the mononymic substantive, *calcar*, is practically conceded by all who employ the mononymic adjective, *calcarinus* in any of its Latin inflections, or in any of its national paronymic forms. If *calcarinus* is sufficiently distinctive, so is *calcar*, from which it is derived. But if *calcar avis* is essential, then the fissure collocated with the elevation so-called should be renamed *calcari-aviana*.

vs. chiasma opticum.—Meynert's *chiasma* is retained in the B. N. A., and even if it is liable to confusion with it or with *Camelinum*. "The chiasma is and probably is the optic nerves. The use of any quali-

fier suggests undesirable variations, like *chiasma nervorum opticornum* and *commissura optica*. Furthermore, the sufficiency of the unincumbered mononym is virtually admitted in the B. N. A. by designating one of the subarachnoid spaces as *cisterna chiasmatis*; it is also used alone by His in the commentaries on the B. N. A., p. 171, line 8.

§ 11. *Tentorium*.—Since this is an anatomic idionym (i.e., no other structure is so called), there seems to be no reason for retaining the genitive *cerebelli*. Indeed, it constitutes a typical case for the application of the principle adopted by all the American committees, that, "other things being equal, a term of a single word is to be preferred to one of two or more."

§ 12. *Falx*.—This case is less simple than the foregoing, since there is also a "*falx cerebelli*." Even, however, if the proposition of the secretary of the committee to call this by the diminutive *falcula* is not finally accepted, the part is seldom mentioned and *the falx* would still be that of the cerebrum. The conditions are comparable with those of *chiasma*. So too *the biceps* is that of the arm; that of the leg may be distinguished as *biceps femoris* or *cruris*.

§ 13. *Callosum*.—*Corpus callosum* is the most familiar example of a group of ten neural terms that are retained in the B. N. A., viz: *corpus restiforme*; *cp. trapezoideum*; *cp. medullare*; *cp. quadrigemina*; *cp. mamillare*; *cp. geniculatum mediale*; *cp. gnc. laterale*; *cp. pineale*; *cp. callosum*; *cp. striatum*. Unlike the cases of *calcar avis* and *chiasma opticum*, where the reduction of the dionym to the mononym is effected by dropping the genitive or adjective, with *corpus callosum* we advocate the elimination of the substantive and the employment of the neuter adjective as a noun. Such usage in ordinary language is too thoroughly sanctioned for discussion, and the B. N. A. contains *cavum*, *planum* and *stratum*.

Many writers employ the term "fissura calloso-marginalis," and thereby indirectly concede the superfluity of *corpus*.

In the B. N. A. this is avoided by designating the fissure in question by the genitive *cinguli*, and the furrow along the dorsum of the callosum, "sulcus corporis callosi." Nevertheless, in the express rejection of "pedunculus corporis callosi" in favor of *gyrus subcallosus* (170-172), there lies the practical admission that *corpus* is superfluous.

§ 14. *Striatum*.—In the elimination of *corpus* and the employment of the neuter adjective as a substantive this is analogous with *callosum*, but we are not aware that the potential secondary adjective, *striatalis*, is in actual use.

§ 15. *Dura* and *pia*.—From *corpus callosum*, *dura mater* and *pia mater* differ in two respects. First, the noun has a special though somewhat fantastic application, which it may be worth while, for the present at least, to mention in a lecture or systematic treatise, although we believe it would be simpler to regard the omitted word as *tunica* or *membrana*.

Secondly, the retained adjectives are feminine instead of neuter. This, however, cannot be urged as an objection by the framers or adopters of the B. N. A. *Cornea*, *sclera* and *arachnoidea* are feminine adjectives used as nouns (the last in "arachnoidea encephali"). Finally, although the useless substantive is retained in "dura mater spinalis" and "filum duræ matris spinalis," the very next terms in the B. N. A., *cavum epidurale* and *cavum subdurale*, are indirect and probably unintended, yet none the less complete, precedents for *dura* pure and simple, and for the substantive employment of any and all feminine adjectives whatsoever.

Indeed, the employment in this country of *dura* and *pia*, and of the adjectives *dural* and *pial*, is now so common that it is hardly necessary to add that in Foster's "Medical Dictionary" these constitute major headings, "dura mater" and "pia mater" being merely synonyms, and that the sentence,

"The superficial vessels of the cerebrum are lodged between the two laminae of the pia" occurs in James' "Medical Dictionary" published in 1743.

§ 16. *Dentatum*.—In the choice between this and *nucleus dentatus* there are involved two separate questions: (a) The use of *nucleus* (with a masculine adjective) in place of *corpus* (with a neuter); (b) The employment of an adjective of either gender as a substantive. The latter is considered in connection with *callosum* and *dura* §§ 13, 15. The substitution of *nucleus* for *corpus* seems to us to constitute a step backward, as tending to obscure the commonly accepted distinction between the part in question, with the analogous part in the oliva, on the one hand, and the "nuclei" of origin of the various nerves on the other.

The question of preference between *nucleus* and *nidus* (Spitzka), or *nidulus* (C. L. Herrick) is not considered in this report. See the article by C. L. and C. J. Herrick, cited in § 1, I.

§ 17. *Epiphysis*.—Since there appears to be a general consensus respecting *hypophysis* as preferable to *corpus pituitarium* or *glandula pituitaria* for the ventral appendage of the diencephalon we regard it as desirable to designate the most familiar and—in mammals at least—most conspicuous dorsal appendage by a term suggesting the antithesis. The advantage so gained seems to us to outweigh all that may be claimed for either of the synonyms, *corpus pineale* (B. N. A.) or *conarium*. The two other dorsal outgrowths are the *saccus dorsalis* ("Recessus suprapinealis" of the B. N. A.) and the *paraphysis* (in lower vertebrates). Certainly the context would always avert the possibility of confounding the epiphysis of the brain with an epiphysis of a bone.

§ 18. *Operculum*.—The case of this term is peculiar. As a mere word it is identical in our list and in the B. N. A.

But in the latter it is employed as a collective, including all the gyral folds by which the insula is more or less completely covered. This of course involves the employment of qualifiers for the several subdivisions, and the B. N. A. has "pars frontalis," "pars temporalis" and "pars parietalis" rather than (as we think would have been preferable) *operculum frontale*, *op. temporale*, and *op. parietale*.

But inasmuch as the parietal operculum, between the chief divisions of the Sylvian fissure, is much more frequently mentioned than the others it seems to us simpler to apply the unincumbered word *operculum* (as indeed it probably was originally) to this region, and to specify the others by the use of prefixes indicative of their relative positions *viz.*: *praeoperculum*, *postoperculum* and (for the orbital portion) *suboperculum*.

§ 19. *Oblongata*.—The case of this term is more complicated than any of the others, and our disposition of it less satisfactory to ourselves. There are involved three quite distinct questions, *viz.*: as to morphologic interpretation, determination of the basis of the name, and choice between a mononym and a dionym.

The third is the simplest and may be disposed of first. If the alternative is between *medulla oblongata* and *oblongata*, our choice is decidedly the latter, and upon the following grounds:

Oblongata is a single word and so universally and exclusively associated with the region in question as to obviate all chance of misapprehension.

Medulla is not only needless but has been used in so many senses as to be perplexing.

As a mononym *oblongata* is subject to adjective modification (*oblongatalis*, *oblongatal*, etc.), and to combination with prefixes (*postoblongata*, etc.).

Nevertheless, it must be admitted that neither *oblongata* nor *medulla oblongata* have much to commend them save their antiquity and general acceptance. *Oblonga* would be

quite as appropriate and as much better as it is shorter. *Bulbus*, with or without a qualifier, would be correlated with the phrase *paralysis bulbaris* which seems to be quite well established.

In the B. N. A., as in most treatises on human anatomy, the term *medulla oblongata* is applied to the region between the "spinal cord" and the pons. But while in the adult human brain the pons constitutes an obvious and fairly constant boundary, its extent varies in other mammals, and in the other vertebrates, as in the human embryo, it is absent. In the B. N. A. the ventral portion of the cerebellar segment is called pons. But in reptiles, for example, where there is no pons, this segment has still a ventral portion; what shall it be called?

For the present we recommend simply the reduction of *medulla oblongata* to *oblongata*; if this word be retained at all, then in the future it must be determined whether the region that is covered by the pons in mammals shall be otherwise specified, *c. g.*, by *præoblongata*.

§ 20. *Fissura centralis*.—This term involves two wholly distinct questions, concerning what may be called its generic and specific components respectively. In accordance with the general abandonment of eponyms or personal names determined upon in the B. N. A.,* all the derivatives of *Rolando* must be discarded in favor of *centralis* and its derivatives. Those who prefer the eponym should show that Rolando's figure and description really merit such commemoration, and should be also at least consistent in the employment of derivatives. *Paracentralis*, *præcentralis*, and *postcentralis* have no other justification than topographic reference to *centralis*; yet it is by no means uncommon to find in one and the same paper "fissure of Rolando" and "paracentral lobule."

As to the generic terms, fissure and sulcus, in the B. N. A. the former is restricted to the *sylviana* (there called "cerebri

* Excepting the case of *sylviana* and its compounds this principle has been advocated by the secretary of this committee since 1880.

lateralis"), the collateralis, the occipitalis ("parietooccipitalis"), the calcarina and the hippocampi. The striatum is regarded (p. 170) as the ental correlative of the sylvian; hence it may be inferred that *fissura* indicates a corrugation of the entire parietes, while *sulcus* indicates a linear furrow not represented in the cavity by a corresponding elevation. Fully conceding the desirability of recognizing the two groups of cerebral furrows,* the following considerations lead us to question the advisability of employing the two generic words in the senses proposed in the B. N. A.:

1. *Fissura* and its various paronyms are already well established and commonly associated with cerebral topography. This subject, on account of its various relations, physiologic, pathologic, surgical, and psychologic, has already gained much general interest. *Sulcus* is a comparatively unfamiliar word. It is distinctly Latin and technical. Its Latin plural, *sulci*, is even more so. It does not readily lend itself to paronymization, *sulc* and *sulcuses* both being somewhat unacceptable.

2. *Sulcus* has recently been employed by several neurologists for "intraventricular" depressions which are less likely than the cerebral furrows to become subjects of general interest.

3. Even if all assented to the view that the striatum is the ental correlative of the sylvian fissure confusion might easily occur in connection with the occipital. In the fetus this is distinctly total, but in the adult the general thickening of the parietes renders the eminentia occipitalis ("bulbus cornu posterioris") inconspicuous or quite invisible so that the furrow would commonly be described as partial; in other words, the same furrow would be a "fissura" in the fetus and a "sulcus" in the adult.

1e words *fissura* and *sulcus*, or in their or-

ometimes distinguished as total and partial, or as . The former seem to be preferable, since with the *rietes* is involved, whereas *complete* seems to imply

dinary associations, serves to remind us of the proposed distinction. Hence there is liability to misuse and confusion. Many actual instances of this might be cited, but the following may suffice.* Edinger apparently intends to apply *fissura* to the total fissures, and the occipital is so designated in the index; but on a figure it is called *sulcus*. Kölliker attributes "sulcus calcarinus" to Huxley, but both use *fissure* in the explanation of a figure. Flower applies to the supra-orbital, *fissura* and *sulcus* indifferently. Huxley says that the cerebral surface becomes complicated by ridges and furrows, "the gyri and sulci"; but the first of the "sulci" to be mentioned is the "sylvian fissure", and the second "the fissure of Rolando", the latter also being designated on a figure as the "sulcus of Rolando". Flower and Lydekker say that "the sylvian fissure" is one of the most constant of the "sulci". In the last two cases the generic designation of the shallower furrows is made to include both kinds, and this usage is apparently sanctioned in the B. N. A. in introducing "gyri cerebri" and "sulci cerebri" as comprehensive names, and then specifying certain "sulci" and "fissurae"; see Table IV, 15, 20.

§ 21. *Cornu Dorsale*.—As between this and the "columna (grisea) posterior" of the B. N. A. are involved two distinct issues, *viz.*: (a) toponymic, between *posterior* and *dorsalis*; (b) organonymic, between *columna* and *cornu*. The former will be considered in connection with *cornu ventrale* and *radix dorsalis*.

Probably most anatomic teachers will sympathize with the German committee in their objection to the application of *cornu* to what is really one of several ridges of a deeply fluted column of gray nervous tissue constituting the core of the "spinal cord"; ridges that resemble "horns" only when artificially exposed upon transection. Yet, in nine cases out of ten, the artificial appearance presented upon section is what is first offered the student, and misapprehension is seldom

* The exact references are given in the paper, "Neural Terms" etc., p. 253.

occasioned thereby. Upon the whole, this has seemed to us a good case for the observance of Huxley's aphorism as to the unadvisability of interfering with terms that are well established and have a definite connotation, even when they may be etymologically inappropriate, *c. g., callosum*.

The assignment, in the B. N. A., of *columna* to the ridges of the myelic cinerea naturally involved the replacement of that word as commonly applied to the intervening masses of alba by some other word; the German committee selected *funiculus*. If *cornu* be retained, *columna* will be available as hitherto.

§ 22. *Cornu ventrale*.—As an objection to this term it might be urged that consistency would involve the application of the same words to the "middle" or "descending" extension of the "lateral ventricle," which the German committee call "*cornu inferius*". It will be seen later, however, that for the three ventricular extensions we recommend *præcornu*, *postcornu* and *medicornu*. Even if these are not generally adopted ambiguity may still be avoided by the use of *cornu frontale*, *c. occipitale*, and *c. temporale*, perfect examples of a class of terms that suggest parts or regions already familiar.

§ 23. *Radix dorsalis*.—In the B. N. A., the roots of nerves are distinguished as "anterior" and "posterior," and the same adjectives, appropriate only for the erect human body, are applied to the myelic sulci, columns, cornua, and commissures, the folds of the axilla, the aspects of the thigh, the tubercles of the cervical vertebrae, the sides of the stomach and other viscera, and the valves of the heart.

So long as comparative anatomy was merely an adjunct of zoöpotomy it was natural to hesitate over the employment of adjectives applicable to the animal body in whatever attitude it might assume. But the human anatomists of the future will have been zoötomists first, and neither reflection

nor experience lead us to recognize serious difficulties in the general application of terms of intrinsic toponymy.

Among the more conspicuous recent converts to the method which was employed by Owen in 1861 ("Comparative Anatomy of Vertebrates," I, 272-273) is Professor Michael Foster. The sixth edition of his "Physiology", part III, p. 856, has the following footnote :

"It is very desirable to use the terms "dorsal" and "ventral" for the parts of the cerebro-spinal axis which lie respectively near the dorsal or back part, and the ventral or belly part of the body, instead of the terms *posterior* and *anterior* ; but if this is done, the use of the word *dorsal* to denote the region of the cord between the lumbar and cervical regions is apt to lead to confusion ; hence the introduction of the word *thoracic*. If this use of *dorsal* and *ventral* be adhered to, *before* and *behind*, *above* and *below*, may conveniently be used to denote nearer the head and nearer the tail (or coccyx) respectively ; *anterior* and *posterior* may also be used in the same sense *except in the case of anterior and posterior fissure and horn, which terms seem too much honored by time to be thrown aside*."

In the seventh edition (1897, p. 922) the concluding words that we have italicised are omitted, a most significant concession. Since the venerable president of the Nomenclatur Commission, von K lliker, preferred *dorsal* and *ventral* (B. N. A. 109-110 ; "Neural Terms", 256) there is encouragement to hope that the change may be sanctioned at the approaching meeting of the Gesellschaft.

§ 24. D. Two hundred and fifty-nine terms, differing more or less from those in the B. N. A., and not already adopted by any other association, although many of them have been in actual use, here and abroad, during periods ranging from five to seventeen years ; Table IV.

After the first five "Termini generales" the terms are enumerated in groups indicated by the numerals I-IX, corresponding respectively to the six definitive encephalic segments

recognized by us; the myelon (spinal cord); the meninges; and the blood-vessels of the brain.

Of the six segmental names, three have been mentioned already, *viz*: Mesencephalon (Category A; § 5) and Rhinencephalon and Diencephalon (Category B; § 6). But since even these have not identical meanings in our list and in the B. N. A., and since with the other three the differences in scope are more or less radical, the two segmental schemas are here summarized for ready comparison; Tables II and III.

Table II.—*Provisional Segmental Schema herein recommended*

I. RHINENCEPHALON

Bulbi olfactorii, with their tracts, part of the aula, and part of the praecommissura

II. PROSENCEPHALON

Palliums, connected by part of the aula and part of the praecommissura

III. DIENCEPHALON

Thalami, including the chiasma

IV. MESENCEPHALON

Crura and quadrigeminum

V. EPENCEPHALON

Pons and cerebellum

VI. METENCEPHALON

Oblongata

Table III.—*Segmental Schema adopted in the B. N. A.*

Partes ventrales

Partes dorsales

VI. TELENCEPHALON

Pars optica hypothalami

Corpus striatum; Rhinencephalon;
Pallium

V. DIENCEPHALON

1 hypothalami

Thalamus; Metathalamus; Epithalamus

IV. MESENCEPHALON

Pedunculi cerebri

Corpora quadrigemina

III. ISTHMUS RHOMBENCEPHALI

Pedunculi cerebri

Brachia conjunctiva ; velum medullare
anteriorius

II. METENCEPHALON

Pons

Cerebellum

I. MYELENCEPHALON

Medulla oblongata

*Pars ventralis**Pars dorsalis*Table IV.—*Category D*

TERMINI NEUROLOGICI GENERALES

A. A. A.

B. N. A.

- | | |
|------------------------|-------------------------------|
| 1. Alba | Substantia alba |
| 2. Cinerea | Substantia grisea |
| 3. Gelatinosa | Substantia gelatinosa |
| 4. Endyma | Ependyma ventriculorum |
| 5. Sulcus interzonalis | Sulcus limitans ventriculorum |

TERMINI NEUROLOGICI PROPRII

(I) RHINENCEPHALON (B)

RHINENCEPHALON

- | | |
|---------------------|-------------------------------|
| 6. Limen | Limen insulae |
| 7. Radix intermedia | Stria intermedia |
| 8. Radix mesalis | Stria medialis |
| 9. Radix lateralis | Stria olfactoria lateralis |
| 10. Praecribrum | Substantia perforata anterior |

11. (II) PROSENCEPHALON

(VI) TELENCEPHALON

- | | |
|--|--------------------------------|
| 12. Hemicerebrum (cerebrum <i>ferè</i>) | Hemisphaerium |
| 13. F. intercerebralis | Fissura longitudinalis cerebri |
| 14. Hiatus tentorii | F. transversa cerebri |
| 15. Gyri | Gyri cerebri |
| 16. Vada | G. profundi |
| 17. Isthmi | G. transitivi |
| 18. Subgyri | |
| 19. Supergyri | |
| 20. Fissurae | Sulci cerebri |
| 21. Subfissurae | |
| 22. Superfissurae | |
| 23. Impressio torcularis | |

24. Fossa sylviana
 25. Fissura sylviana
 26. F. sylviana (*ferre*)
 27. F. praesylviana
 28. F. subsylviana
 29. F. basisylviana
 30. Praeoperculum
 31. Operculum [parietale]
 32. Postoperculum
 33. Suboperculum
 34. G. praecentralis
 35. G. postcentralis
 36. Isthmus centralis
 37. Vadum centrale
 38. F. praecentralis
 39. G. superfrontalis
 40. F. superfrontalis
 41. G. medifrontalis
 42. Pars dorsalis
 43. Pars ventralis
 44. F. medifrontalis
 45. F. subfrontalis
 46. G. subfrontalis
 47. Pars opercularis
 48. Pars praeopercularis
 49. Pars subopercularis
 50. G. mesorbitalis
 51. F. olfactorius
 52. F. orbitales
 53. F. transtemporales
 54. G. transtemporales
 55. G. supertemporalis
 56. F. supertemporalis
 57. G. meditemporalis
 58. F. meditemporalis
 59. G. subtemporalis
 60. G. subcollateralis
 61. G. subcalcarinus
 62. G. parietalis
 63. G. subparietalis
 64. F. postcentralis
 65. F. parietalis
 66. F. paroccipitalis
 67. Isthmus paroccipitalis
 68. Vadum paroccipitale
 69. G. marginalis
- Fossa cerebri lateralis [Sylvii]
Fissura cerebri lateralis [Sylvii]
 Ramus posterior
 Ramus anterior ascendens
 Ramus anterior horizontalis
- Pars frontalis [operculi]
Pars parietalis [operculi]
Pars temporalis [operculi]
- G. centralis anterior
G. centralis posterior
- G. frontalis superior
S. frontalis superior
G. frontalis medius
 Pars superior
 Pars inferior
- Sulcus frontalis inferior
G. frontalis inferior
 Pars opercularis
 Pars triangularis
 Pars orbitalis
- G. rectus
S. olfactorius
Sulci orbitales
Sulci temporales transversi
Gyri temporales transversi
G. temporalis superior
S. temporalis superior
G. temporalis medius
S. temporalis medius
G. temporalis inferior
G. fusiformis
G. lingualis
Lobulus parietalis superior
Lobulus parietalis inferior
- G. supramarginalis

70. F. exoccipitalis
 71. F. lambdoidalis
 72. F. callosalis
 73. F. supercallosalis
 74. F. paracentralis
 75. F. praecunealis
 76. G. callosalis
 77. Reticularis alba
 78. G. paracentralis
 79. F. occipitalis
 80. Isthmus cunei
 81. Vadum cunei
 82. F. inflecta
 83. F. fronto-marginalis
 84. Aula
 85. Porta
 86. Praecornu
 87. Postcornu
 88. Medicornu
 89. Caudatum
 90. Caput
 91. Cauda
 92. Paratela
 93. Eminentia occipitalis
 94. Fimbria
 95. G. dentatus
 96. Splenium
 97. Genu
 98. Rostrum
 99. Stria mesalis
 100. Stria lateralis
 101. Indusium
 102. Septum lucidum
 103. Hemiseptum
 104. Pseudocoelia
 105. Cortex
 106. Medulla
 107. Lenticula
 108. Pallidum
 109. Amygdala
 110. Corona
 111. Pars frontalis
 112. Pars parietalis
 113. Pars temporalis
 114. Pars occipitalis
 115. Praecommissura
- S. corporis callosi
 Pars subfrontalis [S. cinguli]
 Pars marginalis " "
 S. subparietalis
 G. cinguli
 Substantia reticularis alba [Arnoldi]
 Lobulus paracentralis
 F. parietooccipitalis
- Foramen interventriculare [Monroi]
 Cornu anterius [ventriculi lateralis]
 Cornu posterius " "
 Cornu inferius " "
 Nucleus caudatus
 Caput nuclei caudati
 Cauda nuclei caudati
 Lamina chorioidea epithelialis
 (Bulbus cornu posterioris)
 Fimbria hippocampi
 Fascia dentata hippocampi
 Splenium corporis callosi
 Genu corporis callosi
 Rostrum corporis callosi
 Stria longitudinalis medialis
 Stria longitudinalis lateralis
- Septum pellucidum
 Lamina septi pellucidi
 Cavum septi pellucidi
 Substantia corticalis
 Centrum semiovale
 Nucleus lentiformis
 Globus pallidus
 Nucleus amygdalae
 Corona radiata
 Pars frontalis
 Pars parietalis
 Pars temporalis
 Pars occipitalis
 Commissura anterior [cerebri]

(III) DIENCEPHALON (B)

- 116. Postgeniculum
- 117. Praegeniculum
- 118. Recessus epiphysialis
- 119. Saccus dorsalis
- 120. Habenula
- 121. Supracommissura
- 122. Trigonum habenae
- 123. Albicans
- 124. Tuber
- 125. Praehypophysis
- 126. Posthypophysis
- 127. Radix mesalis [tractus optici]
- 128. Terma
- 129. Postcommissura
- 130. Medicommissura

(V) DIENCEPHALON

- Corpus geniculatum mediale
- Corpus geniculatum laterale
- Recessus pinealis
- Recessus suprapinealis
- Habenula
- Commissura habenularum
- Trigonum habenulae
- Corpus mamillare
- Tuber cinereum
- Lobus anterior [hypophyseos]
- Lobus posterior
- Radix medialis
- Lamina terminalis
- Commissura posterior [cerebri]
- Massa intermedia

(IV) MESENCEPHALON (A)

- 131. Crusta
- 132. Postbrachium
- 133. Praebrachium
- 134. Postgeminum
- 135. Praegeminum
- 136. Quadrigeminum
- 137. Decussatio brachii
- 138. Fossa intercruralis
- 139. Lemniscus mesalis
- 140. Crus
- 141. Recessus postcribralis
- 142. Recessus praepontilis
- 143. Entocinerea
- 144. Intercalatum
- 145. Postcribrum
- 146. Sulcus oculomotorius
- 147. Cimbria
- 148. Valvula
- 149. Frenulum

(IV) MESENCEPHALON

- Basis pedunculi
- Brachium quadrigeminum inferius
- Brachium quadrigeminum superius
- Colliculus inferior
- Colliculus superior
- Corpora quadrigemina
- Decussatio brachii conjunctivi
- Fossa interpeduncularis [Tarini]
- Lemniscus medialis
- Pedunculus cerebri
- Recessus anterior [fossae interpeduncularis]
- Recessus posterior [fossae interpeduncularis]
- Stratum griseum centrale
- Substantia nigra
- Substantia perforata posterior
- Sulcus n. oculomotorii
- [Tractus pedunculi transversus?]
- Velum medullare anterius*
- Frenulum veli med. ant.*

150. (V) EPENCEPHALON

- 151. Sulci [cerebelli]
- 152. Folia

(II) METENCEPHALON

- Sulci cerebelli
- Gyri cerebelli

*Two of the components of the "Isthmus rhombencephali," the "third" segment of the B. N. A.

- 153. Vallis
- 154. Lingula
- 155. Lobus quadrangularis
- 156. Pars cephalica
- 157. Pars caudalis
- 158. Lobus praesemilunaris
- 159. Lobus postsemilunaris
- 160. Cacumen
- 161. Postpedunculus
- 162. Praepedunculus
- 163. Fasciculus obliquus
- 164. Medipedunculus
- 165. Trapezium
- 166. Arbor
- 167. Postramus
- 168. Praeramus
- 169. Cortex
- 170. Embolus
- 171. Globulus

- Vallecula cerebelli
- Lingula cerebelli
- Lobulus quadrangularis
- Pars anterior
- Pars posterior
- Lobulus semilunaris superior
- Lobulus semilunaris inferior

- Brachium conjunctivum [cerebelli]
- Fasciculus obliquus [pontis]
- Brachium pontis
- Corpus trapezoideum
- Arbor vitae

- Substantia corticalis
- Nucleus emboliformis
- Nucleus globosus

172. (VI) METENCEPHALON

- 173. Calamus
- 174. Sulcus interzonalis
- 175. Striae acusticae
- 176. Lingula
- 177. Metaporus
- 178. Sulcus dorsalis
- 179. Sulcus ventralis
- 180. Recessus postpontilis
- 181. Pyramis
- 182. Sulcus ventrolateralis
- 183. S. dorsolateralis
- 184. Restis

(I) MYELENCEPHALON

- Pars inferior fossae rhomboideae
- Sulcus limitans [fossae rhomboideae]
- Striae medullares
- Taenia ventriculi quarti
- (Apertura medialis ventriculi quarti [foramen Magendii])
- Fissura mediana posterior
- F. mediana anterior
- Foramen caecum
- Pyramis [medullae oblongatae]
- Sulcus lateralis anterior
- S. lateralis posterior
- Corpus restiforme

185. (VII) MYELON

- 186. Myelon cervicale
- 187. Myelon thoracale
- 188. Myelon lumbale
- 189. Conus
- 190. Filum
- 191. Sulcus ventralis
- 192. Sulcus dorsalis
- 193. Sulcus ventrolateralis
- 194. Sulcus dorsolateralis

MEDULLA SPINALIS

- Pars cervicalis
- Pars thoracalis
- Pars lumbalis
- Conus medullaris
- Filum terminale
- Fissura mediana anterior
- Sulcus medianus posterior
- Sulcus lateralis anterior
- Sulcus lateralis posterior

195.	Sulcus intermedius ventralis	(Sulcus intermedius anterior)
196.	Columnae [albae]	Funiculi medullae spinalis
197.	Columna ventralis	Funiculus anterior
198.	Columna lateralis	Funiculus lateralis
199.	Columna dorsalis	Funiculus posterior
200.	Entocinerea	Substantia grisea centralis
201.	Commissura ventralis alba	Commissura anterior alba
202.	Commissura ventralis cinerea	Commissura anterior grisea
203.	Commissura dorsalis	Commissura posterior
204.	Cornua cinerea	Columnae griseae
205.	Cornu laterale	Columna lateralis
206.	Reticula	Formatio reticularis

(VIII) MENINGES

207.	Filum durae	Filum durae matris spinalis
208.	Arachnoidea	Arachnoidea encephali et a. spinalis
209.	Cisternae	Cisternae subarachnoidales
210.	Postcisterna sen c. cerebellaris	Cisterna cerebellomedullaris
211.	Cisterna sylviana	Cisterna fossae lateralis cerebri [Sylvii]
212.	Cisterna cruralis	Cisterna interpeduncularis
213.	Medicisterna	Cisterna venae magnae cerebri
214.	Metatela	Tela chorioidea ventriculi quarti
215.	Metaplexus	Plexus chorioideus ventriculi quarti
216.	Paraplexus	Plexus chorioideus ventriculi lateralis
217.	Glomus	Glomus chorioideum
218.	Acervus	Acervulus
219.	Prosoplexus	
220.	Aulatela	
221.	Auliplexus	
222.	Portiplexus	
223.	Paratela	

(IX) ARTERIAE, VENAE ET SINUS ENCEPHALI

224.	Arteria medicerebellaris	A. cerebelli inferior anterior
225.	A. postcerebellaris	A. cerebelli inferior posterior
226.	A. praecerebellaris	A. cerebelli superior
227.	A. praecerebralis	A. cerebri anterior
228.	A. medicerebralis	A. cerebri media
229.	A. postcerebralis	A. cerebri posterior
230.	A. terminalis	
231.	Circulus	Circulus arteriosus [Willisi]
232.	A. praecommunicans	A. communicans anterior
233.	A. postcommunicans	A. communicans posterior
234.	A. praechorioidea	

235. A. postchoroidea	A. chorioidea
236. A. praecribrales	
237. A. postcribrales	
238. A. spinalis ventralis	A. spinalis anterior
239. A. spinalis dorsalis	A. spinalis posterior
240. A. praeduralis	A. meningeae anterior
241. A. postduralis	A. meningeae posterior
242. A. mediduralis	A. meningeae media
243. A. parviduralis	
244. A. subduralis	
245. Sinus lateralis	Sinus transversus
246. S. longitudinalis	S. sagittalis superior
247. S. falcialis	S. sagittalis inferior
248. S. tentorii	S. rectus
249. S. subpetrosus	S. petrosus inferior
250. S. superpetrosus	S. petrosus superior
251. Torcular	Confluens sinuum
252. Venae supercerebrales	Venae cerebri superiores
253. V. medicerebrales	V. cerebri media
254. V. subcerebrales	V. cerebri inferiores
255. V. supercerebellares	V. cerebelli superiores
256. V. subcerebellares	V. cerebelli inferiores
257. V. velares	V. cerebri internae
258. V. magna ?	V. cerebri magna [Galenae]
259. V. septalis	V. septi pellucidi

§ 25. The schema recognized by us * is based upon that which has appeared in the last three editions of Quain's "Anatomy." It differs therefrom mainly in assigning segmental value to the olfactory region, and in replacing *thalamencephalon* by *diencephalon*.

§ 26. Our adhesion to the segmental schema of Quain (with the modifications just specified) is in accordance with the following propositions:

1. More reliance is to be placed upon comparative anatomy and embryology than upon the structure and development of the adult human brain.

* In a more extended form it appears in the paper of the secretary of the committee, "Neural Terms," p. 326, and in the abstract of his paper, "The Definitive Encephalic Segments and their Designations," *Proceedings of this Association*, May, 1897, p. 29.

2. The number of segments and their components may be assumed without determining precise boundaries.

3. A certain set of regions may be provisionally regarded as definitive segments, and thus as if practically coördinate, notwithstanding doubts as to their really having equal ontogenetic or phylogenetic value.

4. Criticism of a proposed schema as unsatisfactory entails no obligation to offer another that shall be satisfactory in all respects; it merely constitutes a ground for refraining from the hasty adoption of the new one.

§ 27. What seem to us the most undesirable features of the segmental schema of the B. N. A. may be stated briefly as follows:

1. The recognition of the constriction between the cerebellum and the quadrigeminum as a segment under the name "Isthmus rhombencephali."

2. The subdivision of the general thalamic region, and the allocation of the chiasmatic portion, under the name *pars optica hypothalami*, to a different segment.

3. The non-recognition of the prominence and functional importance of the olfactory portion of the brain with most vertebrates.*

4. The premature assumption of the representation of the dorsal and ventral zones beyond (cephalad of) the mesencephalon.*

5. The replacement of *prosencephalon* by *telencephalon* for what is regarded as the most "anterior" segment.

6. The transfer of *metencephalon* from the segment including the oblongata to that of the cerebellum.

7. The replacement of *metencephalon* by *myelencephalon* which was employed by Owen for the entire cerebro- as no etymologic warrant excepting in

retary of this committee, "What is the morpho-
portion of the brain?", *Science*, Feb. 4, 1898.

the designation of the "medulla spinalis" by *myelon*, which is not done in the B. N. A.

8. Beginning the enumeration of the segments with the one next the myelon (spinal cord), in contravention of the universally accepted custom of beginning the enumeration of an axial series with the most cephalic (anterior).

On the other hand, it is gratifying to find in the schema of the B. N. A. that the cerebellum and the oblongata are held to represent two definitive segments, and that *diencephalon* replaces *thalamencephalon*.

F. H. GERRISH,
G. S. HUNTINGTON,
B. G. WILDER.

REPORT OF THE MINORITY OF THE COMMITTEE ON ANATOMICAL
NOMENCLATURE.

We, the undersigned, a minority of the Committee on Anatomical Nomenclature of the Association of American Anatomists, regret extremely the report of the majority which was accepted at the recent meeting at Ithaca.

In view of the important bearing that this matter has upon the standing of this Association among similar bodies in the civilized world, we feel it our duty to speak with the greatest plainness, more especially as we have to reproach ourselves that, through a desire to spare the feelings of Dr. Wilder, whose theories are essentially embodied in this report, we have allowed those theories to make greater progress than we should. Believing that his system is too fantastic to have the slightest chance of general adoption, we did not oppose its first advances with proper firmness and did not object to certain changes, which, while apparently insignificant, have logically paved the way to more objectionable ones.

We wish to call attention to the fact that anatomical nomenclature as at present used in America is not in the state of hopeless confusion that might be inferred from the con-

tention advanced by Dr. Wilder. While it has grave defects, it practically answers the purpose reasonably well, the only serious confusion arising from the nomenclature of Dr. Wilder and his followers. It is most important that changes in an existing nomenclature should not be made without grave reasons, and that expressions foreign to general usage, uncouth in sound and barbarous in construction, should not be introduced to isolate us from the rest of the scientific world.

Many of the recommendations of the majority in the recent report simply confirm general usage, but in some instances a very radical departure has been taken which threatens to be followed by other steps in the same direction which can only bring American anatomy into disgrace. We believe that the primary requisites of a terminology are that it should be clear and intelligible to both foreign and native workers, and that the first duty of anatomists is to remove the difficulties that prevent a uniform system. We consequently deprecate the adoption of these terms at the present time, as tending to widen the breach, already too great, between the anatomical nomenclature of different countries. It should not be forgotten that, in 1895, the *Anatomische Gesellschaft* considered some of these very terms and formally protested against their use, deprecating the radical remodelling of anatomical language that would be involved and the disturbance of international co-operation in anatomical and medical work that would necessarily ensue. To adopt terms already repudiated by the principal association of foreign anatomists is to defeat the end to which the Committee on Nomenclature should direct its efforts.

We feel called upon to point out that a minority report made by one of us and put into the hands of the secretary the committee, was not read to the Association. Though custom may be considered a grievance, we advising of it to the small meeting at Ithaca influenced the result, for there were present where the report was read but seven persons besides t

Who signed it, and none of these, except the associates of Dr. Wilder, has ever paid any special attention to nomenclature. Our contention is that in the action of that meeting the true feeling of the Association is not represented, and that in the past the importance of the matter has not been sufficiently considered. The question is now prominent, and we propose at the next meeting to call upon the Association to reconsider its acts from the beginning.

As it may be plausibly said that the Association should have known what it was doing, and ought not to shirk the responsibility of its acts, we must point out the precise state of affairs. On the one side is Dr. Wilder, a man of great perseverance, firmly convinced of the merit of his system, to the furtherance of which all his energies are devoted; on the other side men who, while vaguely desirous of some reform, are yet devoid of any active interest in the matter, and though unwilling to accept the entire results of Dr. Wilder's views, are, from their personal regard for him, anxious to admit as much of his system as will do no great harm. It is easy to see that these sides are ill-matched, and that the active, energetic man, with confidence in his system, must win against the good-natured ones whose chief business has been to protect the Association without hurting Dr. Wilder's feelings, and who were only too glad when they could lay the matter aside.

The time has come when it is our imperative duty to forego personal considerations, and, however disagreeable it may be both to Dr. Wilder and to ourselves, to say that we will reconsider all that we have hitherto done, and that in future we will open the door to nothing that may lead to the acceptance of a system that is generally repulsive to educated men and at variance with universal usage.

FRANK BAKER,
THOMAS DWIGHT.

January 29, 1898.

COMMENTS ON THE MINORITY REPORT BY THE SECRETARY OF THE
COMMITTEE.

The document mentioned in the fifth paragraph of the "Report of the Minority" was received by me on the morning of December 30, 1897, was considered that day by the majority of the committee, and on the 13th of January was returned to its writer with the expectation that it would be incorporated in the formal "Statement of the Objections of the Minority," provided for by the Association (see page 9 of the *Proceedings*).

Its non-presentation to the Association was due to a misapprehension on my part shared by the other members of the majority, one of whom was present when it was handed to me.

An inquiry respecting it by the Secretary of the Association, dated February 4, was answered to the effect that it had been returned to its writer.

Thereafter, in the effort to formulate the majority report in addition to other duties, regular and unusual, the very existence of the document was forgotten.

Conscious of absolute freedom from any intent to suppress adverse opinion, I can only declare my profound regret at the oversight.

It is to be hoped that the conviction of individual responsibility expressed in the Minority Report will be shared by the other members of the Association, and that whatever action is taken at the next meeting will be sanctioned by the presence of all concerned.

BURT G. WILDER.

THE MUMMIFICATION OF SMALL ANATOMICAL AND ZOOLOGICAL SPECIMENS.

BY PIERRE A. FISH, D. SC., CORNELL UNIVERSITY,
ITHACA, N. Y.

The preservation of anatomical and zoological specimens, without continuous immersion in the various preservative fluids, presents many obvious advantages, not the least of which is the non-necessity for particular attention, when the process is once completed.

One of the greatest difficulties encountered in the preparation of dry specimens is that of shrinkage and accompanying distortion. In certain cases this may be successfully guarded against by careful attention to the details of hardening. In others, where there is normally a great amount of fluid present, as for example, the brain, there must necessarily occur some shrinking, which, if it be uniform, need not cause distortion. Specimens hardened in potassium bichromate and then dehydrated shrink very much less than those hardened in alcohol.

The present method has been carried on during occasional intervals in the regular work of the laboratory since 1893, and specimens prepared at that time have retained exactly their original appearance. Under this system, the time devoted to them is scarcely noted, and there is no fear of deterioration of the specimens, since all of the fluids used are preservative.

The essential factor of the process is the complete dehydration of the specimen. In the case of the zoological specimens a factor almost, if not equally, important is the killing of the animal. The method giving the best results with fishes, amphibia and reptiles has been to kill them gradually, and for this a dilute solution of chromic acid, from $\frac{1}{4}$ per cent. to $\frac{1}{2}$ per cent. has been found to answer every purpose. A few drops of ether or chloroform may be added to hasten narcotization, if desired. As the animal dies, its tissues seem to gradually relax and its form assumes a natural position devoid of all distortion. After a short immersion in cold water, to remove as much of the chromic acid as possible, the animal is removed

to 50 per cent., 70 per cent., 80 per cent., and 95 per cent. alcohol, until thoroughly dehydrated. It should remain in each of these baths at least a week. If carried through too hurriedly, there will be shrinkage. To complete the dehydration, the animal is immersed in the oil of turpentine, until it becomes transparent. No hard and fast limit can be set for the period of immersion in these fluids, for it will vary according to the size of the animal to be mummified.

The superfluous turpentine is allowed to drain from the specimen for a few hours, and the animal is then ready for its final bath of castor oil. It may remain here indefinitely, or until the oil has thoroughly infiltrated all of the tissues. The specimen may then be removed and the oil permitted to drain from it for a day or two. It then receives a coat of an alcoholic solution of white shellac, with a camel's hair brush, and this is repeated at frequent intervals, until the surface becomes firm and glossy. In the case of some salamanders and perhaps some others, the colors that have faded out during the hardening process may be reproduced upon the shellacked surface in water colors and again shellacked.

If a sufficient quantity of the oil has not drained away the specimen is liable to become sticky again. Time and reapplication of the shellac will remedy this trouble.

Of the fixed oils, castor oil, with its pale color, has uniformly proved successful. Others may be found just as efficient. Linseed oil proved very satisfactory, except that it darkened the color of the tissues. The coating of shellac unites with the oil, forming a layer, which, as it dries, retards or prevents the evaporation of the oil.

With the exception of the precautions to be observed in the matter of killing, the remainder of the directions apply to the preparation of small anatomical specimens. The method has not, as yet, been attempted with specimens of much size, but for the smaller organs, as for example, the heart and brain, and fetuses, it has proven successful. The brain, however, on account of the great proportion of water present, almost invariably shrinks a certain amount. Although it has not yet been tried upon all the viscera, every indication points to its successful operation upon such organs as the spleen, kidneys and similar parts.

In the case of small animals there is sometimes an infolding of the parietes, a result which might be expected when

we consider the size of the body cavity in some of these creatures. This may be prevented by injecting into this cavity some substance which hardens when it cools and is not too miscible with the castor oil or turpentine.

Paraffin, although soluble in turpentine, will answer for this purpose very well, if injected into the body cavity just before the immersion of the specimen in the castor oil. The infolding of the parietes may, however, occur sometimes before dehydration is completed, and if the paraffin be injected before dehydration, the infolding is prevented and the walls may retain their natural relation until the specimen has been dried in its natural position.

Not infrequently some of the specimens, if not hurried too much, mummify in the most perfect form without the above precaution. The process usually renders the tissues quite brittle, and in the case of the small animals an arm, or leg, or tail may be broken off. These defects are easily remedied by sticking the parts together again with gum arabic mucilage and, when dry, shellacking the parts again.

Mummies, as such, are not, of course, available for dissection, although the form and relations of the parts are quite well preserved. Fairly good dissections may, however, be occasionally obtained by treating the mummy to a reversed process; immersing it for some days or a week in alcohol with occasional changes.

In many instances, the specimen has a very close resemblance to a model, and sometimes has been mistaken for such by the laity. A specimen dissected to show some specific feature, or a series of such specimens, may be mummified and fulfil every function of a model and possess the higher attribute of being absolutely true to nature. It is the genuine article, and not an imitation.

The method, thus far, has been applied only to smaller specimens, because such are more conveniently manipulated. With the proper amount of patience and material we may expect just as favorable results from larger specimens.

The paper was discussed by Drs. Wilder and Huntington.

RELATIVE DIAMETERS OF THE HUMAN CHEST.

BY WOODS HUTCHINSON, A. M., M. D., UNIVERSITY OF
BUFFALO, N. Y.

DR. HUTCHINSON had read a paper on "Some deformities of the chest in the light of its ancestry and growth," at the meeting of the American Medical Association, June 1 to 4, 1897. (See Jour. Amer. Med. Asso., Sep. 11, 1897, p. 512-517.) A synopsis of the paper was given before the Association of American Anatomists for the purpose of getting the opinions of the members. The subject was discussed by Drs. Huntington, Baker and Gerrish.

DR. GERRISH suggested that the outline of the chest at any given level could best be obtained by an apparatus constructed on the principle of the instrument used by hatters in measuring the cranium—a series of horizontal, converging rods, whose proximal ends would touch the surface in a continuous line. Such a machine could be simply and cheaply made, and its results would be much more accurate than those obtained by the other methods proposed.

It would be well to have the measurements of different subjects made on the plane of some specified point or points of the bony skeleton—as, for example, the mid-axillary line of a certain rib—rather than on the level of a soft part like the nipple, the position of which is very different in the various races, and even in the same individual at different times and in different, though normal, physiological conditions.

DR. HUNTINGTON said: "Dr. Hutchinson's interesting results seem to sustain his conclusions admirably. I would like to suggest to him that the level of the metasternal cartilage has always appeared to me to be an unsatisfactory point for the determination of the thoracic perimeters, notwithstanding the fact that most statistical collections of thoracic measures (including those of Wintrich and Hirtz) use it, or the level of articulation with the mesosternum, as determining the point for measuring the caudal thoracic perimeter. The difficulty of correctly determining the position of the cartilage in the

living subject, the variability of the same and of the entire sternal apparatus as regards vertical measure, and the occasional approximation of the seventh, and at times of the eighth, costal cartilage ventrad of the metasternum, are all conditions which render the determination and relative position of the point too uncertain for use in standard measurements. I think it would be preferable, as Dr. Gerrish has suggested, to use the intersection of a standard rib with one of the axillary lines to determine the level at which perimeters should be measured."

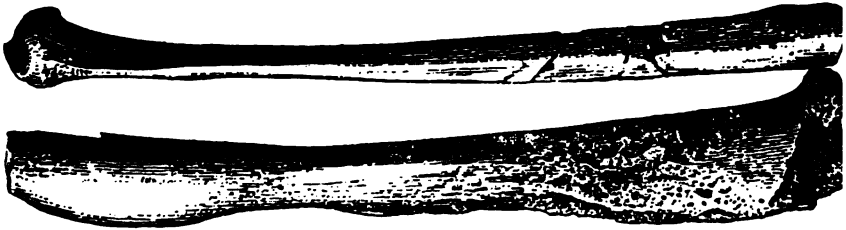
PRECOLUMBIAN SYPHILIS.

BY D. S. LAMB, A. M., M. D., ARMY MEDICAL MUSEUM,
WASHINGTON, D. C.

The question of the antiquity of syphilis has been so often discussed and the literature of the subject is so vast that to justify any addition thereto one should have something new to present. The same statement may be made, though in less degree, in regard to the question of precolumbian syphilis; that is, the existence of syphilis on the American continent prior to the coming of Columbus. The testimony which I have to offer on the affirmative side consists in the fact of a series of human bones from one and the same skeleton, which show the lesions of osteo-periostitis, both hyperostotic and ulcerative; lesions therefore showing a constitutional disease. The shafts of the bones are alone affected; the *joint surfaces* so far as they have been preserved *are normal*. These bones were found under circumstances detailed below, by Mr. Clarence B. Moore, of Philadelphia, and were sent by him to Dr. Washington Matthews, Surgeon U. S. Army, a well known archæologist and anthropologist, for his opinion as to the nature of the lesions. The ill health of Dr. Matthews at that time precluded his giving any attention to the matter and the duty was devolved on me.

The bones were at first temporarily, afterwards permanently, deposited in the U. S. Army Medical Museum in this city (Washington). They are numbered 11,247 to 11,253 Pathological Series, and 3,579 to 3,583 Provisional Pathological. They consist of the humeri, right ulna, radii, femora, tibiæ

and fibulæ. They are of the usual dark color and quite friable; the medullary cavity filled with dark sand and rootlets. There is some platycnemism and pilasterism, conditions so commonly found in aboriginal bones. They show in some places irregular patches of flat, reticulated, hyperostotic growth, in others a more uniform rounded thickening. The illustration shows the appearance of the left tibia and fibula; the ulcerative stage is well marked. The skull was not sent and its condition is not now known. In the present state of our knowledge I know of no disease except syphilis in which a series of bones of the same skeleton show the lesions illustrated and described. These bones were exhibited by me in the Pathological Museum at the meeting of the British Medical Association at Montreal, and a brief mention of them was made in the British Medical Journal, Nov. 20, 1897, p. 1487. Prof. Osler's remark on seeing them was that "This man had the pox."



DR. J. C. MCCONNELL, DEL.

The bones were obtained by Mr. Moore in the course of his investigations of Indian mounds in Florida and adjoining States; investigations which have occupied him for some years and in which he is, I believe, considered an expert. The results of his work have been published by the Academy of Natural Sciences, Philadelphia.

Among the mounds investigated by him was one named the "Lighthouse" mound; described in his "Additional Mounds of Duval and Clay Counties, Florida, 1896," pp. 24 and 25. This was one of the mounds of the Florida coast, situated on the north side of the St. Johns river at Fernandina, Nassau County. He states that it was in a shell-field and in the neighborhood of others; about 150 yards south of the lighthouse; about one mile east of the town of Fernandina. He demolished the entire mound and found that it was 12 feet

high, with a base diameter of 75 feet. When stripped of the dense growth of vegetation which covered it, it was very symmetrical; the ascent at some points was at an angle of 44 degrees. Excavations three to four feet deep to the west and northwest of the base showed whence the earth for the mound had been derived. There had been some previous investigation in the immediate summit of the mound.

The strata of the mound were well defined, and under them and in a central position was a cone of white sand. A little north of the center, these strata from above downwards were as follows: 2 feet 6 inches of dirty brown sand; one foot of dark sand with oyster shells; one foot of pink sand mingled with oyster shells and white sand; 5 feet 8 inches of yellow sand; 7 inches of dark sand and oyster shells, and 2 feet of light sand to the yellow sand of the base. At various points in the mound were pockets of sand artificially colored with *hematite*. The distance between the summit of the mound at the center and the yellow sand at the base where charcoal and human remains were wanting was 15 feet. He says:

"Exclusive of loose bits of bone, doubtless from the previous excavation, 74 skeletons, all seemingly in anatomical order, were met with and one deposit of charred and calcined human remains. We are of course unable to estimate the number of skeletons thrown out or carried away prior to our visit. The first interment was encountered 10 feet in from the southwestern margin of the base. With very few exceptions no art relics lay with human remains; and if we except a stone hatchet found with a skeleton 8 feet from the surface, and some beads of shell with another interment, no art relics were associated with burials in the body or on the base of the mound.

"In no previous mound work have we found so great a percentage of pathological specimens as in this mound, and, as has not been the case in other mounds, entire skeletons seemed affected, and not one or possibly two bones belonging to a skeleton. The pathological conditions were so marked and cranial nodes so apparent that, in view of the fact that no objects positively indicating white contact were discovered in the mound, though the utmost care was exercised by a trained corps of assistants, we are compelled to regard the bones with the greatest interest since, evidence of contact with the whites being wanting, we must look upon these bones as of precolumbian origin. We may state here that all the bones preserved

by us came from depths in the mound which insured their derivation from original burials. These bones found 8 to 12 feet from the surface, and lying beneath numerous undisturbed layers are as unmistakably of an early origin as any yet described and much more reliable than most."

I have quoted thus fully from Mr. Moore to show the painstaking character of his work; it commends itself to our confidence and his opinion to our acceptance.

A discussion of the historic and philologic aspects of pre-columbian syphilis is outside of the scope of this article; but mention may be made of two papers by Dr. Gustav Brühl; one read before the Cincinnati Med. Society, May 4, 1880; (Cin. Lancet and Clinic, 1880, V, 467-492); the second in the same Journal, (March 8, 1890, 275-280), and two papers by Dr. Albert S. Ashmead of New York City, (one in the Medical News, October 31, 1891, p. 511; the other in Jour. Amer. Med. Ass., 1892, XVIII, 473-5).

On the pathologic side the most important paper is that of Dr. Joseph Jones of New Orleans, which gives an account of his explorations in 1868-'9 among the mounds, earthworks, etc., of the aborigines of Tennessee. These were published by the Smithsonian Institution (Contributions to knowledge, No. 259, Oct., 1876), in 1880, 171 pp. folio. In several places he mentions finding bones which he believed to show the lesions of syphilis, and adds, p. 49: "The presence of syphilitic nodes and marks of syphilitic ulceration in these bones is not only of interest in its medical aspect but also in its bearing on the probable age of these remains. If the disease were unknown to the aborigines in this portion of America until its introduction by the Spaniards, then we have here evidence that the *stone grave race* of Tennessee were living in the time of the discovery and exploration of the North American continent by the Spaniards. . . . In all my research I found no implement of European manufacture within and around the mounds." Again, p. 72, "The diseased bones which I collected from the stone graves of Tennessee are probably the most ancient *syphilitic bones* in the world; and this discovery appears to be of great importance in the history of specific contagious diseases, in that it confirms the view held by some pathologists that syphilis originated in the Western hemisphere."

On page 49 he gives a description of these bones, thus: "Several of the skeletons in these mounds [on the Cumber-

land river] bore unmistakable marks of the ravages of syphilis. In one skeleton, which appeared to manifest in the greatest degree the ravages of this fearful disease, the bones of the cranium, the long bones of the arm (the humerus, ulna and radius) and the long bones of the thigh and leg (the femur, tibia and fibula) bore deep erosions, nodes and marks of severe inflammatory action. Many of the long bones were greatly thickened, presenting a nodulated, eroded and enlarged appearance. When sections were made, they presented a spongy appearance, with an almost complete obliteration of the medullary cavities. . . . Every competent medical observer to whom these bones have been submitted, has concurred in the view that *syphilis is the only disease which could have produced such profound and universal structural ulcerations.*" [The italics are mine.] A fuller description is given on p. 66.

April 27, 1878, Prof. Jones showed some bones of this kind from the stone graves and mounds of the Mississippi valley before the New Orleans Medical and Surgical Association. (N. O. Med. and Surg. Jour., 1877-8, V, 926-941.) He claimed that the most recent of the bones as shown by historical records of the migrations of the aboriginal inhabitants and the exact dates of the periods at which they abandoned the sections of country where these remains are found, cannot be less than 200 years, whilst the oldest, as shown by the annular rings of trees growing on the mounds and graves, may exceed 500 years.

I understand that Prof. Putnam of Harvard, who went over about the same territory as Prof. Jones (Peabody Reports, vol. II, p. 305), considers these remains prehistoric, although not prepared to admit that the bones are syphilitic.

The instances in which individual human bones showing lesions suggestive of syphilis, have been found in the Indian mounds of the United States, are many. The objection has however very properly been made that these bones cannot be received as evidence because there is no known lesion of bone which is absolutely pathognomonic of syphilis, unless it be the *caries sicca*, to which the eminent Virchow has drawn particular attention. The objection is illustrated in the following cases.

In 1881 Dr. F. W. Langdon of Cincinnati (Jour. Cin. Soc. Nat. Hist., 1881, IV, 237-257), in a paper which was part of a series of four papers on the Madisonville (Ohio) Prehistoric

Cemetery, figured (Fig. 14, p. 255), a tibia which he said was suggestive of syphilitic lesion; the disease was bilateral.

At a meeting of the New York Pathological Society, Dec. 14, 1881 (Med. Record, 1882, XXI, p. 49), Dr. Fessenden N. Otis showed a tibia which had been sent to him by Dr. D. L. Huntingdon, Surgeon U. S. Army, Curator of the Army Medical Museum, and which was thought to show the syphilitic lesions. In the discussion which followed and in which Dr. Otis took part it was developed that the members were unwilling to accept this one bone and its lesions as evidence of syphilis. The bone had been obtained by Dr. S. H. H. Brinkley from a mound at Andersonville, Ohio. In 1884 Dr. J. P. MacLean of Hamilton, Ohio, who had seen the bone, discussed the question of precolumbian syphilis (Amer. Med. Jour. St. Louis, 1884, XII, 360-7) and placed himself on the negative side.

Dr. Wm. F. Whitney of Harvard (Boston Med. and Surg. Jour., 1883, CVIII, p. 365) rightly claims that in order to establish precolumbian syphilis it is necessary to secure a whole skeleton from an undoubtedly precolumbian interment, and that a number of bones of this skeleton should show evidences of syphilis. In this connection he discusses a specimen (733 Army Med. Museum, Washington) which was found by Mr. S. S. Lyon in a mound in Kentucky, and another specimen (18,264) of the Peabody Museum, Harvard.

Hyde of Chicago (Amer. Jour. Med. Sci., 1891, CII, 117-131) describes and figures bones supposed to be prehistoric and which at first sight might be thought to be and indeed might be syphilitic. He submitted one of these bones to Prof. Prudden of New York City, who declined, however, to express any opinion one way or another as to its syphilitic character. Hyde concludes that as yet precolumbian syphilis is not proved; at any rate so far as the bones he describes are concerned.

The whole subject has been considered by Dr. E. L. Morgan of this city in an article in the Virginia Medical Monthly (1894-5, XXI, p. 1042 *et. seq.*), who inclines strongly to the **negative side**.

Works of Virchow before the Berlin Dermatologic, November 12, 1895, "Beitrag zur Geschichte der nat. Zeitsch., III, 1896, 1-9), show that he was as
ly to accept the testimony of the bones, although

he might be willing to admit their precolumbian character. Of the lesions described by Jones, he said, "Aber keine von diesen Veränderungen ist so deutlich charakterisiert, dass ich sagen könnte; sie muss syphilitisch sein." But the diseased shafts and normal joint surfaces of the bones I have described can have no sufficient parallel in the *Höhlengicht* or cavegout which he described, and the question of phosphorous poisoning cannot, of course, be raised. It seems to me, therefore, as I have already said, that there is no disease of which we know, except syphilis, which can produce the multiple lesions of the skeleton such as I have described. I am content to leave the question of the precolumbian character of the bones in the hands of Mr. Clarence B. Moore.

ABSTRACT OF A PAPER ON THE MEMBRANA
BASILARIS, THE MEMBRANA TECTORIA, AND
THE NERVE ENDINGS IN THE HUMAN EAR.

BY HOWARD AYERS, PH. D., PROFESSOR OF HISTOLOGY IN
THE MEDICAL DEPARTMENT OF THE UNIVERSITY OF
MISSOURI.

The material for this investigation consisted of the ears of three human embryos and two adult males. The embryos were two and a half, three and a quarter, and four months respectively, and since the ear capsules of these five subjects were obtained in a *practically living condition* it was possible to use with good success both the Golgi and the methylene blue staining methods in studying them. Both the adults furnished ears that were normal beyond question; they came, the one from an electrocuted murderer and the other from a robber shot *in flagrante delicto* and instantaneously killed. In the former case the ears were removed at once and preserved in an aqueous solution of corrosive sublimate while in the latter they were studied in their fresh condition. Of the embryonic ears one was studied in the fresh condition, one was used for serial sections, while the third was used for the dissection of the membranous ear. This exceptionally favorable adult material has given excellent results, and we may rest assured that the histology is perfectly normal and unaf-

fectured by sickness or organic disease, and since I have used every care to preserve the living conditions in my preparations, and, by previous study of the living cochlea of mammals other than man, thoroughly prepared myself to detect alterations due to reagents, I feel sure that all the histological characters with which we have to deal have been fixed in death as they were in life. In 1892, after several years spent in the investigation of this subject, I published a monograph on the vertebrate ear in which I devoted special attention to the anatomy and histology of the mammalian (and human) cochlea, with the result that my discoveries necessitated a reconsideration of the prevailing views on the physiology of the ear. Since that time I have made several other contributions to the histology of the ear, mainly on the innervation of its sense organs. The morphological facts are admitted without question by those who have taken the pains to examine my preparations. Most physiologists and some anatomists, however, have not made use of either the facts or the physiological conclusions which necessarily flow from them, and so far as I know they have not troubled themselves to find out the facts. Under the circumstances, and especially because of the excellent human material which I have been fortunate enough to secure and subject to a careful histological analysis, I am glad to bring before the Society of American Anatomists this statement of a few important facts of cochlear anatomy, which are essential to a correct knowledge of the physiology of the cochlea.

MEMBRANA BASILARIS.

The membrana basilaris is that part of the connective tissue wall of the cochlear tube which lies under the sense organ and forms its floor as well as the basement membrane of its epithelium. It is far from being the most delicate wall of the cochlear tube, for the membrane of Reissner is much thinner and less resistant. The importance of the basilar membrane to previous investigators was due to the dominant Helmholtz-Hensen piano-string theory of tone perception. But it is neither elastic enough nor thin and homogeneous enough to merit the assumptions of this physical hypothesis. According to observations the human basilar membrane consists of layers of fibers, three of which run radially, from the free edge of the *lamina ossa* to the

base of the *stria vascularis*, being continuous with the perosteum of the former structure and with the connective tissue frame work of the latter part. The fourth layer, if it is permissible to call a small number of separated fibers a layer, runs at right angle to the other three, or spirally with reference to the parts of the cochlea. These layers are quite distinct and are arranged as follows: an upper and a lower layer of fine fibers inclosing between them a layer of large fibers. The imperfect layer of spiral fibers is most apparent upon the upper surface of the basilar membrane. The basilar fibers are the direct product of a part of the connective tissue cells of the embryonic basilar membrane which have been transformed into long cylindrical fibers, for the most part single, but occasionally branched.

AUDITORY CELLS.

The hair-bearing acoustic cells are cylindrical in shape, those of the inner row being shorter cylinders, so short, in fact, that they become ovoidal. They are surrounded and supported by the peculiarly modified non-nervous cells of the organ of Corti. The hair cells are much shorter than the supporting elements and do not reach the basement membrane, or as it is here called, the basilar membrane, a fact of much significance in view of certain physiological hypotheses. The hairs arise from the tops of cells as a wisp which involves the whole cell cap, and they do not, as some observers have asserted, form a crescentic or horse-shoe shaped outline upon the cell cap. Each cell bears on an average two dozen delicate, flexible, filamentous hairs which sweep inward from the cell to end free in the endolymph above the *limbus spiralis*. The whole hair is thus supported by or floats in the endolymph, and all the hairs from the aggregate of hair-bearing cells are so closely placed that they exert a capillary attraction upon each other, and thus when they are torn loose from the tops of the cells they remain adhering in the form of a long band or ribbon which has been called the *membrana tectoria*, or damper, from its supposed role in auditory physiology. The long hairs are the percipient elements of the cochlea instead of the connective tissue fibers of the basement membrane of the cochlea, and the ear thus agrees with eye, nose and other sense organs in the disposition of its percipient, recipient and transmitting apparatus.

THE NERVE ENDINGS IN THE EAR.

The cochlear nerves, when traced from the spirally twisted cone of medullated fibers lying in the modiolus outward to the cochlear ganglion, are found to occasionally unite with or give off another fiber which is not to be regarded as a collateral, since such fibers extend to the hair cells at the periphery in the organ of Corti. In doing so its fibrils do not pass through but around the ganglion cell through which all the fibrils of the *regular* nerve fiber must pass. On gaining the ganglion cell, the regular nerve fiber issues from the peripheral border of the cell as a single fiber (bipolar cell), or as 2—6 distinct nerve fibers (multipolar cell), all of which then take their way toward the organ of Corti, branching as they go. These fibers may leave their radial course at any point and pass at right angles to their former course for greater or less distances (spiral nerve fibers). However, all nerve fibers leaving the cochlear ganglion sooner or later attain the organ of Corti where they terminate in the bases of hair cells (first method), or in a subacoustic nerve net from which fibers are given off to the hair cells (second method). There is thus formed a compound nerve net disposed in two layers one above, the other immediately beneath the hair cells, which net serves to connect the hundreds of hair cells in different regions of the epithelial ridge in which the hair cells lie embedded.

Interepithelial or free nerve ends may occur, but I have never seen them. All such cases are apparent, not real, so far as my observations go. The intracellular endings are genuine and real, and here, as elsewhere, one positive fact of observation is worth many negative observations. The facts I have stated above are all statements of my positive observations on the basilar membrane, hair cells, hairs and nerve ends.

ANUS VULVALIS.

By J. T. DUNCAN, M. D., PROFESSOR OF ANATOMY, WOMEN'S
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Embryology teaches us that, in early fetal life, the alimentary canal is but a blind gut; that, as development proceeds, the tube lengthens both upward and downward; that the cephalic prolongation ultimately opens into the ectodermic invagination of the mouth, and that the downward prolongation opens into the ectodermic invagination known as the anus. This is the normal way in which the canal is formed.

In certain cases, development does not proceed normally. One of the abnormalities noticed is that no anal ectodermic invagination takes place, and the gut terminates by a blind extremity. Such cases are spoken of as *imperforate* anus. A rarer abnormality (speaking of the female), is seen when there is no anal invagination, but the intestine opens in some other part, such as the vulva.

But an abnormality of the most extreme rarity is seen when we find an apparently normal anal invagination and the intestine opening, not into the anus, but into the passage of the vulva.

To either of the two latter conditions the term *anus vulvalis* is applied, meaning that the true anus is in the vulva, not on the external surface.

So rarely do we see a case of anus vulvalis—in which there is also a normal anus—that a few notes regarding a patient showing this condition—who has been under observation for some years—may be of interest to the Association.

The principal interest of such a case centers, to my mind, in the question of the presence or absence of the anal sphincters. Before considering this point, the history may be briefly presented. Mrs. ——— is, at the present writing, about forty years of age. She was born in Scotland, of Scotch parents. At her birth the fact that the rectum really opened into the vulva was not noticed by either the doctor or the nurse, a circumstance not greatly to be wondered at, as a normal anus

seems to exist. When the mother recovered from her confinement, however, and assumed charge of the infant, the fact that the feces passed from the "front passage" was noticed by her.

As soon as possible thereafter the child was carried to the doctor, who made some attempt at operation, but without accomplishing his object. No other attempt has been made to correct the abnormal condition, which remains to the present time.

Up to the age of seven years, the mother at various times assisted the child to accomplish defecation. In doing so, the opening of the intestine into the vulva was found to be small, and it often tightly grasped the finger when it was introduced. On account especially of the smallness of the opening the mother had much difficulty in the earlier months of the child's life in securing proper evacuation of the bowels—particularly when there was any constipation. Digital aid was given, frequently up to the age of four or five years, only occasionally between five and seven, and not at all since the latter period.

Mrs. ——— married about the age of twenty. She has come under my notice in her confinements (six confinements and two miscarriages). In several of these confinements I have been obliged to assist her with forceps.* In none of them has the anatomical peculiarity caused any trouble.

Family history. There is no history of hereditary tendency towards anus vulvalis, or any other abnormality of this nature. The three female children born to the patient are perfectly normal in this respect.

In regard to her general health, the patient is a healthy woman, but has suffered to some extent from indigestion. She claims to have perfect control of the bowel, even when diarrhœa may be present. No difficulty is felt in constipation.

Present condition. On digital examination the anus is felt in the normal situation. On passing the finger, however, it enters a very shallow blind cavity. On inspection there appears to be a perfectly normal anus. No pigmentation is observed. Very slight lateral pressure will open the orifice. The shallow depression, already spoken of, can then be inspected. It is seen to be lined by common integument.

On passing, I may remark that she has had no puerperal fever on any of her occasions, which seems to show that the *bacillus communis coli* is not the active cause of puerperal fever.

The vulvar opening is found just above the posterior commissure. No excoriations exist about the part. The opening is large, easily admitting two fingers. The edges are lax, and there is no contraction felt upon the finger when it is introduced.

How is control of the bowel secured in the case of the normal intestine? It is secured first, by the sigmoid flexure, with its superior sphincter.* Passing below this point, however, the feces finally accumulate in the rectum, and involuntary evacuation is provided against by the action of the external and internal anal sphincters.

How is control maintained in the case of the patient spoken of? First, by the sigmoid flexure and superior sphincter, as in the normal intestine. Secondly, below this point control cannot be assisted by the external sphincter, which must surround the external anal opening. Is there, then, an internal sphincter? In regard to this point Professor Dwight (Amer. Jour. Med. Sci. CIX, 1895, page 433), in an admirable review of the literature of the subject, can only find one case in which a sphincter is spoken of. The tendency seems to be to deny the presence of an internal sphincter, some holding that the thickening of the longitudinal fibers accomplishes the object.

The matter can, of course, only be properly settled by dissections. But in the case before us I consider that control is secured by an internal sphincter for the following reasons: 1. No other force seems able to secure the result. 2. An observation made during one of the confinements. In applying the forceps it was noted that no feces were in the vulva, the opening of the intestine being apparently closed. On bringing down the head a very little, feces escaped, showing that they were present in the rectum, but prevented from escaping by some controlling force.

As against the presence of an internal sphincter may be urged: 1. That no such band can be felt. 2. The fact that the opening does not contract on the introduction of the finger.

In regard to the first point it may be said that the inability to recognize a sphincter by digital examination does not prove that it is not present. As to the second, we have to remember that the peristaltic action of the intestines is checked at the

* "Here [at the sigmoid flexure] their progress [*i. e.* of the feces] is checked for a time by a circular band of muscle, the superior sphincter."—Starling's Physiology, 1895, page 242.

superior sphincter until some stimulus is applied to the rectum below that point. This may be given either by the presence of feces or by the introduction of the finger or other foreign body through the vulvar anal opening. But involuntary muscular tissue responds very slowly to stimuli—so slowly that no appreciable contraction would take place during an ordinary examination.

On a review of all the circumstances of the case, it would appear that the circular fibers here are sufficiently aggregated to form a veritable internal sphincter, and that control of the bowel is thus secured. And the consideration of this case would further lead us to suppose that where continence of feces exists we may always expect to find an internal sphincter.

SEBACEOUS GLANDS IN THE MUCOUS MEMBRANE OF THE MOUTH.

BY DOUGLASS W. MONTGOMERY, M. D., PROFESSOR OF DISEASES OF THE SKIN, UNIVERSITY OF CALIFORNIA, AND W. G. HAY, M. D., ASSISTANT TO THE CHAIR OF DISEASES OF THE SKIN, UNIVERSITY OF CALIFORNIA.

[Read first at the Meeting of the Alumni Association of the University of California, October 5th, 1897.]

The reading of Anatomies would not lead one to suppose that sebaceous glands occur in the mouth, although they are described as being found in the lips. In the two following cases, however, sebaceous glands were found in the mucous membrane of the mouth, and if the inferences deduced from these findings be correct, the presence of such glands in the oral cavity cannot be infrequent.

Our attention was drawn to the subject in the following way :

For some years past we have noticed curious yellow discolorations that occur in the mucous membrane of the mouth and lips in many people. These discolorations are pin-head sized and less, discrete, and of a dull yellow color. They are situated chiefly on the vermillion border of the lips, and along the interdental line of the cheek pouch as far back as opposite the last molar teeth. Very frequently the contrast in

color makes them appear to be elevated into papules, and sometimes they actually correspond to little elevations, which, however, as far as we have observed, are soft, and not demonstrable as papules by touch. These discolorations give rise to no subjective symptoms whatever, and in no instance was our attention drawn to the condition by the person having them. They were never seen to undergo any degenerative or inflammatory process, and in many instances remained stationary both in regard to size and number, while in others they steadily increased in number so as to form a marked discoloration or even deformity, as for instance of the lips.

Age seemed to play an unimportant rôle in the occurrence of these discolorations, for while mostly seen in adults, yet once at least in the University of California Clinic they were observed in an infant.

Since these curious discolorations were first observed by us, their essential nature gave rise to a good deal of speculation, till at length two patients were found who were willing to allow small pieces of themselves to be devoted to science.



DRAWN BY DR. I. KATZUKI.

In March, 1897, a piece of mucous membrane, including one of the yellow discolorations above referred to, was clipped out of a left cheek pouch, well back from the corner of the mouth. The patient, a not very robust man, twenty-six years of age, had been attending the University of California Clinic for a long time on account of a syphilitic infection contracted in July, 1895. There were quite a number of the yellow spots present both in the cheek pouches and in the red border of the lips, and in the lips it was noticed that they were becoming more and more distinct.

The microscopical examination of the piece of tissue snipped out showed the presence of a small lobulated sebaceous gland.

The other specimen was obtained from a man, thirty-six years of age, who had come to the University of California Clinic on August 6th, 1897, on account of a lesion which was diagnosed as syphilitic, situated in the left moustache and nostril. He had also a deep ulcerative patch in the cheek behind the left molar teeth. He had had a venereal sore four years before.

There were a number of yellow discolorations in the cheek pouches which aroused our curiosity, especially one well behind the left angle of the mouth, which was slightly elevated. He allowed it to be snipped out, and on microscopical examination a good sized sebaceous gland was discovered.

The fact that both the men from whom the specimens were obtained had syphilis was of no significance. There are always quite a number of syphilitic patients in the clinic, and it just happened that these two had the yellow discolorations, and were willing to allow the biopsy.

That the structures found were really sebaceous glands admits of no doubt. The glands were lobulated sacks well sunk into the connective tissue of the mucous membrane of the cheek. The lobules were entirely filled with large polyhedral cells, each cell having a well marked spherical nucleus, and a distinct cell wall. Outside the nucleus each cell was occupied by a reticulated structure. These epithelial cells gave the mosaic appearance seen in sections of the sebaceous glands. One of the sections passed perpendicularly through the mouth of a gland, and the epithelium of the buccal cavity could be followed down into the gland duct in the same way that the epithelium of the skin is continuous with the lining of the cutaneous sebaceous glands. The lumen of the duct was filled with amorphous substance and shrivelled epithelial cells. Then again the yellow spots by which the presence of these glands was made manifest clinically was just what might be expected should a sebaceous gland be situated under the epithelium, for the contained fat would shine through the translucent mucous membrane as a spot of yellow discoloration.

As for these yellow discolorations in their clinical aspect, they have received very little attention by writers. J. A. dyce, of New York, is the only observer who seems to have written on the subject. He says that they are not in-

frequent, and other clinicians also stated to him that they had observed the same appearances in the lips and mouth. According to Fordyce, however, the yellow discolorations in the case that formed the subject of his paper were due to a granular change in the protoplasm of the epithelial cells of the affected mucous membrane. It is entirely possible that Fordyce was correct as far as this single observation was concerned, for the change in the protoplasm may have been a fatty one, which would, of course, have given the same yellow color as the fatty change that normally occurs in the epithelial cells of the sebaceous glands.* Allowing, however, that the yellow discolorations observed by us are only in a fair number of cases caused by the presence of sebaceous glands, then these glands would be frequent in the mucous membrane of the mouth.

DR. HUTCHINSON said: "I think the findings of Dr. Montgomery are extremely interesting and suggestive. I should like to know whether the glands in the sections submitted are in a condition of inflammation and whether attention was attracted to them by any such process. It is singular how close the resemblance is between the sebaceous glands proper and the mucous glands of this region, due, of course, to their common ancestry.

"In fact, in the absence of a hair-follicle it would be difficult in these sections to distinguish between mucous glands whose lining cells had undergone some fatty degeneration and imperfect sebaceous glands."

THE BRANCHES OF THE SUPERIOR MESENTERIC ARTERY TO THE JEJUNUM AND ILEUM.

BY THOMAS DWIGHT, M. D., LL. D.

It is surprising, especially in view of the great development of abdominal surgery of late years, that the arteries of the small intestine below the duodenum should not have been

*A Peculiar Affection of the Mucous Membrane of the Lips and Oral Cavity, by J. A. Fordyce, M. D., "Journal of Cutaneous and Genito-Urinary Diseases," Nov., 1896.

described more accurately. I have looked into some twenty of the leading works in English, French and German without finding a single description that seems to me at all adequate. The general description, in brief, amounts to this: that a dozen or twenty branches arise from the left of the artery; that they presently subdivide, and their inosculating branches form a first series of arches. From the convexity of this first tier the same thing is repeated on a smaller scale. This often, or usually, occurs a third time, and perhaps a fourth or a fifth. Finally from the last arch, vessels (not particularly described) pass to the gut.

Having studied this point of anatomy for several years, often taking notes, I wish to offer the following as a general description, to which, no doubt, there will be found plenty of exceptions. The most important fact, however, is constant throughout all but the lower part of the gut, namely, that the systems of arches cease at some distance from the gut, and that from the arcades, as I will name the terminal line, arises a series of straight vessels running to the gut.

The number of branches from the left side of the superior mesenteric artery is very variable; there may be twenty, but there are rarely more than six or seven of good size, the others being, for the most part, insignificant. The first artery is generally rather small, but it is followed by from four to six large ones, generally arising near together, which supply the upper half of the intestine. The remainder are smaller. The first two or three divide into an ascending and a descending branch, each of which inosculates with the corresponding branch of the neighboring artery, thus forming a single row of arches, from the convexity of which a series of straight vessels goes to the border of the gut. This system is a very striking feature, which shall be considered as a whole later. Near the beginning of the small intestine, the most frequent modification of this plan of arches is the appearance of small loops connecting, near their origins, the two arches, into which an artery divides. The arcade is thus formed, chiefly by the subdivisions of the primary branches, and slightly by these connecting links.

The next modification to occur is that the branches may give off secondary branches from their sides (I think that it is uncommon for there to be more than one on each side), which subdivide at their ends and insinuate themselves into

the system of the primary branches. At the same time the secondary loops at the bifurcations become more frequent, and thus, perhaps near the beginning of the second quarter of the gut, we often find an approach to a second tier of arches. A little further along, this may become more unmistakable. The arcade, whence the vasa recta spring, is now rather nearer the gut. I believe that very often a double tier of arches is by no means easy to recognize anywhere. On the other hand, very often below the middle of the gut, while the size of the vessels diminishes, the complexity of the arches increases. Sappey declares that it has not been given to him to see four or five tiers, but it is correctly taught by some French authors that the greatest complexity is at the middle. It would be more accurate to say below the middle. I think that the more numerous the tiers the more insignificant the vessels. Towards the very end of the ileum the arrangement is uncertain. There is a good sized anastomosis between the termination of the superior mesenteric artery and its ileo-colic branch. This may run parallel to the last part of the ileum and perhaps only one centimeter from its border, or it may be three times as distant. In the former case the terminal twigs go directly to the gut; in the latter there may be one or more rows of minute arches.

The *vasa recta* in the upper part of the mesentery present a very characteristic picture of radiating lines. They are, for the most part, simple, but sometimes branching. Anastomoses, however, practically never occur between them in the mesentery. They are sometimes described as dividing at the gut to send one branch to either side, and also as being arranged so that the entire vessels are distributed alternately to one side or the other. Without saying that the former disposition may not occur, I am satisfied that the latter is the usual one. The length of the vasa recta near the beginning of the small intestine is four or five centimeters (rarely less than the former). After the first third of the intestine is passed, they are smaller but still characteristic, and continue so to near the lower end. At the termination of the ileum they may be less than one centimeter long, small and irregular.

COMPARATIVE ANATOMY AND EMBRYOLOGY
AS AIDS TO THE TEACHING OF HUMAN
ANATOMY IN THE MEDICAL COURSE.

Illustrated by Diagrams.

BY GEORGE S. HUNTINGTON, M. D., COLUMBIA UNIVERSITY, NEW YORK CITY.

[Published in "Amer. Jour. Med. Sci.," 1898, Vol. CXVI, pp. ——]

Discussed by Drs. Baker, Wilder and Fish and Mr. Ward.

MR. WARD said: "I have been much interested in Dr. Huntington's paper. In this connection it may be of interest to note that even osteological workmen never rank as first class *preparateurs* of the human skeleton unless they have had considerable previous experience in comparative osteology.

"Abnormalities are not only more quickly recognized, but their simian or quadrupedal affinities can be detected only by men possessed of such comparative training. Some of the charts exhibited remind me of a valuable series of models by Deyrolle, of Paris, which should prove very useful in the class-room. He has produced models illustrating not only the general anatomy and the embryology of types of the various classes of invertebrates, and of vertebrates as well, but has illustrated the nervous and the circulatory systems alone of these forms, in two series, than which nothing could be more convenient. I mention these models, as they are undoubtedly unknown to the majority of American teachers. Since the issue of Dr. Auzoux' incomparable but costly preparations, perhaps nothing of equal merit was produced until these Deyrolle models appeared."

A "SKIN-HEART."

BY WOODS HUTCHINSON, A. M., M. D., UNIVERSITY OF
BUFFALO, N. Y.

[Read by title. Dr. Hutchinson had published a paper entitled "The 'skin-heart' as a factor in the human circulation: with special reference to the Brand and Schott treatments" in the "Boston Med. and Surg. Jour.," number 18, 1897, p. 511-515.]

A COMPARISON OF THE BRAIN OF THE FUR SEAL (*CALLORHINUS URSINUS*) WITH THE BRAINS OF SOME OTHER CARNIVORA.*

PIERRE A. FISH, D. SC., ITHACA, N. Y.

The average canine brain, as a matter of convenience, may be accepted as a simple type of a carnivore brain. The fissures are clearly demarcated, and there is an absence of much branching or secondary fissuration.

Around the Sylvian there are three arched fissures separating the cortical substance into four distinct folds or gyres. In the brain of cats, and occasionally in dogs, we find that the arched fissure nearest the Sylvian is not a complete one; that only the pillars are represented, the keystone being absent.

In *Hyena* and *Proteles*, the frontal portion of this arch is wanting (Krueg), but the caudal portion, fissura postica, is well represented. Correlative with this state of affairs, the post-supersylvian, as compared with the presupersylvian, is situated at least twice as far from the Sylvian fissure.

In certain others of the carnivora, no trace of the first arch or Sylvian gyre, with its limiting fissure (anterior postica), is at all present. The first arch, with its fissure, has disappeared, apparently swallowed up by the Sylvian. There are represented, then, on the lateral aspect, only two arched fissures, the supersylvian and lateral, and the three gyres which they separate. In those forms in which only the two arched fissures are present, if the distance from the frontal portion of the supersylvian to the Sylvian be compared with the distance from the latter to the postsupersylvian, it will generally be found to be less in the former, and this becomes much more emphasized in the case of some of the bears, where the frontal portion of an undoubted supersylvian almost enters the Sylvian fissure.

In his description of the brain of the Polar bear, *Ursus maritimus*, Turner† says:

* An abstract of an article prepared for the report of the U. S. Behring Sea Commission, 1896-1897.

† '88. Turner. Report on the seals collected during the voyage of H.M.S. *Challenger* in the years 1873-1876.

"On opening up the Sylvian fissure, I found, to my surprise, that a definite arched convolution was completely concealed within it. It was separated from the convolution which bounded the Sylvian fissure by a deep fissure, which was also concealed. Its anterior limb, not quite so bulky as the posterior, was continued into the supraorbital area immediately external to the rhinal fissure and to the outer root of the olfactory peduncle. Its posterior limb reached the postrhinal fissure and the *lobus hippocampi*. I could not but think that we had here, more completely than in either the walrus or seals, a sinking into the Sylvian fissure of the convolution which ought to have bounded it, so that both the Sylvian convolution, properly so called, and the suprasylvian fissure were concealed within it. If this be a proper explanation of the arrangement, then the three convolutions on the cranial aspect would be sagittal, mediolateral and suprasylvian; whilst the two complete curved fissures between them would be the mediolateral and lateral."

The question quite naturally arises, whether the fissure concealed in the Sylvian may not be the equivalent of the anterior-postica of Krueg, and the two remaining visible on the cranial surface, the supersylvian and lateral.

The mediolateral of other authors does not attain the size or continued length in the frontal direction ascribed to the mediolateral by Turner.

In a specimen of *Ursus Americanus*, I had the good fortune to discover a stage one step beyond that described by Professor Turner. On opening the Sylvian fissure, I found in its caudal wall a completely submerged fissure, with a remnant of the Sylvian gyre which might possibly be mistaken for the insula. A true insula, although small, is present. This submerged fissure I take to be the disappearing vestige of the ectosylvian (Owen) or anterior-postica (Krueg). A study of fetal bear brains with reference to the distinct appearance of the first circumsylvian arch (anterior-postica) would be most important in this connection.

It would seem, then, that the condition thus described in the Polar bear and American bear would represent the method of disappearance, rather than the appearance, of the first circumsylvian arch, and prepare us for the conditions that we find in the sea lion (*Zalophus*) and the seals (*Phoca* and *Callorhinus*).

In the sea lion the conditions regarding the frontal portion of the Sylvian gyre are intermediate between the bears and seals. The presupersylvian fissure approaches very closely to the Sylvian fissure, and the intervening portion of the Sylvian gyre, besides being narrower than in the bear, has also sunk slightly lower than the adjacent surfaces as if anticipating the conditions found in the seals.

In the seals there appears to be some evidence, if the interpretation as to the frontal portion of the supersylvian fissure be correct, that after breaking up into branches, with perhaps some disconnection of its parts, it shows a tendency to follow the example of the anterior-postica fissure, because in *Phoca*, at least, the supersylvian bifurcates a little beyond the free end of the Sylvian, one branch forming a well defined arch around it, the other branch passing on in the frontal region. The branch, however, which forms the arch is not a long one, but it extends to and superficially connects with a vertical fissure, which for half its distance is submerged in the frontal wall of the Sylvian, and crops out again on the ventral aspect of the brain. This condition holds for both hemispheres of *Phoca*. *Callorhinus* throws a little light on this matter. In the right hemisphere the supersylvian is clearly continuous with the vertical fissure submerged in the frontal wall of the Sylvian, but gives off a very short frontal branch. Superficially it is continuous with the postsupersylvian, but a shallow at this point indicates a partial separation. The direct continuity in the depth of the supersylvian with the vertical fissure would seem to point to the fact that the latter, after all, was nothing more than the frontal portion of the supersylvian, namely, the presupersylvian.

In the left hemisphere the parts are a little more complicated. The postsupersylvian is entirely separated, the supersylvian is entirely distinct from the frontal portion and is quite irregular and branching in its course, but mainly vertical in its direction.

Thus, taking the canine brain as exemplifying a simple fissural pattern and passing through the *Felidae* and *Ursidae* and sea lion to the seals, where the fissures are more numerous and complicated by the presence of branches of considerable size, and more or less disconnection of certain of the principal fissures, we may arrive at some understanding of the relationship and changes effected in passing from simple to complex conditions.

In the general form of the brains that of the sea lion seemed to bear a closer resemblance to that of the bear than either *Callorhinus* or *Phoca*—the latter the least of all. The elongated and narrowed frontal portion of the brain as seen in the bear is represented in *Phoca* by a foreshortened and broadened region, less marked in *Callorhinus* and still less in *Zalophus*.

The development of the olfactory lobes is also interesting. They attain their highest growth in the bear, next in *Zalophus*, then *Callorhinus*, and least in *Phoca*.

The triangular area on each hemiserebrum, located between the cruciate and precruciate fissures and the intercerebral cleft, designated by Mivart as the ursine lozenge and believed by him to be of considerable importance in indicating a phylogenetic relationship between the Pinnipedia and the ursine group of carnivora, was developed equally well in *Zalophus* and *Callorhinus*. In *Phoca*, it was not observable, although Turner states that in this form it is present, but rudimentary and concealed in the mesal fissure of the cerebrum.

The length of the lateral fissure in *Callorhinus* is somewhat unexpected, and in relation resembles a continuous lateral and ectolateral of the bear. In the sea lion and *Phoca*, the lateral is a relatively short fissure. In all but the bear, there is an independent ectolateral fissure, but it is not so satisfactorily developed in *Phoca*.

The postrhinal fissure shows an interesting variation in the different forms. In *Callorhinus* and *Zalophus*, it has no connection with the rhinal or Sylvian, but is a direct continuation of the subfissure, postica. In *Ursus*, the subfissure may occasionally reach to it, but as a rule it is distinct and the postrhinal continues as an elongation of the rhinal. In *Phoca*, the separation of the subfissure and the postrhinal is still more marked, so that the rhinal and postrhinal are practically different parts of one and the same fissure, differentiated from each other by the presence of the Sylvian.

The presupersylvian fissure is directly continuous with the supersylvian in *Ursus*; it is likewise continuous in *Zalophus* and in *Callorhinus* except upon the left hemisphere of the pup. In the two fissures are distinctly separated. The sylvian is continuous with the supersylvian in *Ursus* and *Zalophus*, but separated in *Callorhinus*. The sylvian is continuous in *Phoca*, but a dorso-caudal branch is merged buttresses at this point of junction. There was some attempt at separation in *Ursus*.

In the bear there is no elongation of the paracele to form a postcornu; in the sea lion Murie finds a distinct postcornu present; in *Callorhinus* it is quite rudimentary; in *Phoca*, Tiedemann represents the paracele with no appearance whatever of a postcornu. My own specimen, which, so far as I know, is normal, shows a postcornu relatively as large or larger than in the primate brain, with a distinct calcar or hippocampus minor, in which a portion of the splenial appears as a total fissure.

With the exception of the bear, concerning which I have no data, and the additional brain from an adult *Callorhinus*, all of my material was from animals not more than one year of age. It is believed, judging from a comparison of the brain of the young with that of the adult *Callorhinus* as to bulk and complexity of fissuration, that comparatively little or no change occurs, especially in the latter respect.

Mr. Lucas, who has had casts of the cranial cavities prepared from the male and female fur seals, finds but slight difference in the size of the cavities, notwithstanding the fact that the bulk of the body of the male is about four times as great as that of the female.

Of the representatives of the four groups examined, the brain of *Callorhinus* shows a greater number of minor fissures, and a more intricate arrangement and branching of the larger fissures.

With regard to the ground plan of the fundamental fissures, and allowing for the difference in the shape of the brains, that of the eared seals, *Callorhinus* and *Zalophus*, approximates in general more closely to that of the ursine carnivora than does *Phoca*. The latter, or earless seal, in some respects, appears aberrant. The arrangement of the cruciate and postrhinal fissures would seem to link it with the canine and feline carnivora; while the peculiar development of the occipital region and the large development of the postcornu with its calcar point toward primate conditions. The group of lemurs is also said to possess a postcornu, and to have affinities with both the carnivora and the primates.

As a matter of convenience, a table of the more interesting regions in the representatives of the different groups examined, is herewith appended.

The paper was discussed by Drs. Huntington and Wilder.

Region.	Ursus.	Zalophus.	Callorhinus.	Phoca.
1. Subfissure..... (postica?)	Present.....	Present.....	Present.....	Present.
2. Postrhinal.....	Continuation of rhinal, exceptionally postica?	Continuation of sub- fissure.	Continuation of sub- fissure.	Continuation of rhinal.
3. Presupersylvian.....	Continuous with super- sylvian.	Continuous with super- sylvian.	On left hemicerebrum of pup disconnected, but usually continu- ous.	Disconnected.
4. Post supersylvian.....	Continuous with super- sylvian.	Continuous.....	Disconnected.....	Continuous, but some indication of a shal- low.
5. Cruciate.....	Dorsal, just cutting me- sal margin.	Dorsal.....	Dorsal.....	Dorsal and mesal.
6. Minor fissures.....	Rare.....	Not many.....	Numerous.....	Quite numerous.
7. Ursine lozenge.....	Present.....	Present.....	Present.....	Absent.
8. Postcornu.....	Absent.....	Small.....	Small.....	Large.
9. Calcar.....	Absent.....	Absent.....	Absent.....	Present.
10. Medilateral fissure.....	Present.....	Present.....	Present.....	A series of small dis- connected fissures.
11. Marginal fissure.....	Absent.....	Present.....	Present.....	Present.
12. Insula.....	Slight.....	Slight.....	Slight.....	Slight.

DR. HUNTINGTON said: "I have been exceedingly interested in Dr. Fish's demonstration of the fissures in this pinipede and his deductions relative to the general type of the carnivore fissural pattern. The brains which he has shown have given me a most satisfactory view of the mutual relations of Sylvian and first arched fissure, and form a very valuable link in the phylogeny of Turner's concealed fissure."

THE EPARTERIAL BRONCHIAL SYSTEM OF MAMMALIA.

BY GEO. S. HUNTINGTON, M. D., COLUMBIA UNIVERSITY,
NEW YORK CITY.

[Published in "Annals N. Y. Academy of Sciences," XI, 9, 1898.]

The paper was discussed by Drs. Wilder and Hutchinson.

To Dr. Wilder's questions regarding Marsupials and Monotremes, DR. HUNTINGTON replied: "It is curious to note that in both Marsupials and Monotremes the general type of bronchial architecture and pulmonary vascular supply which characterizes the majority of mammalia is already encountered. The eparterial system in these forms is confined to the right side and bronchial in derivation. The extension of the bronchial system cephalad, and the greater respiratory area of the right as compared with the left lung, appear to be very early and constant mammalian characters. This fact confirms me in the views just expressed as regards the probable *cause* leading ontogenetically to the prevalent asymmetry. On the other hand, persistence of what I regard as the primitive Mammalian type and extension of the left lung in the acquisition of an eparterial system are encountered in only the few isolated forms previously described."

DR. HUTCHINSON: "I am sure we have all been impressed with the massive and masterly grasp of the subject shown in this paper, and the huge amount of original work which it represents.

"Personally, however, I must confess that the derivation of

the higher mammalian lung from a bilaterally tri-lobed form appears equally well supported and more probable.

"As Wiedersheim and Howe have pointed out, there has been an unquestionable recession of the cephalic extremities of both chest-cavity and lungs, from the pharyngeal region to the present level, as indicated in the persistence of cervical ribs, etc.

"These receding parts of the lung are of peculiar interest from a pathologic point of view on account of the fact that the one eparterial lobe in the human lung, whether vestige or neomorph, is the starting point of nearly 60 per cent. of all cases of tuberculosis. In the bovine lung, curiously enough, where the cephalic lobes are unusually well developed and the caudal ones undergoing greatest recession from the pressure of the huge pouch, it is these latter which are the commonest starting points of the process."

DR. HUNTINGTON replied : "I confess that the actual conditions upon which we can base conclusions do not appear to me to warrant the view expressed by Dr. Hutchinson. In the first place, the actual *number of lobes* in mammalian lungs is a secondary morphological character. The *type of bronchial architecture* is the main and important factor, and this is to a large extent independent of *lobation*. Both the comparative morphology of the lower vertebrates and, to a certain extent, the ontogeny of the higher types justify us in assuming that the primitive mammalian lung was bilaterally symmetrical. It remains for us to determine which of the two symmetrical forms, the "eparterial" or "hyarterial," is the primary mammalian type. In the absence of positive proof we are compelled to adopt the assumption which is best supported by the known facts. The question is solved to my mind by the consideration of the embryological facts and by the structure of the eparterial system in certain forms. I cannot reconcile the arrangement of the asymmetrical eparterial bronchus of the artiodactyla derived from the trachea with Wiedersheim's hypothesis of a primary bilateral eparterial system. To regard ~~it~~ as anything but a *secondary* development runs counter ~~to~~ known embryological and phylogenetic facts. It seems that the only rational explanation of the artiodactyle al eparterial bronchus is a shifting or migration cephalad or bronchial stem within the framework of the primitive

bronchial tree. Any other hypothesis would necessitate the assumption of *lateral* diverticula from the stalk of the entodermal pouch, in other words a bilateral tracheal side bronchus in addition to the terminal bifurcation of the trachea, as the *primitive* form. Even on this theory the principle of shifting or migration would have to be called on in order to explain the eparterial bronchial bronchus prevalent among mammalia. If, as Dr. Hutchinson suggests, the large size of the ruminant pouch operates as an obstacle to the development of the caudal lung segment, the physiological cause for the migration of bronchial elements *cephalad* may be found in this fact.

"A very grave question arises as to the pertinence, in relation to the bronchial architecture, of the view expressed by Dr. Hutchinson in reference to 'cervical' ribs indicating 'an unquestionable recession of the cephalic extremities of both chest-cavity and lungs from the pharyngeal region to their present level.'

"Of course the distribution of costal elements over the entire vertebral column is to be regarded as the primitive vertebrate condition. That the normal and persistent development of cervical ribs may take place evidently independent of thoracic mechanism and capacity is shown, for example, by the avian cervical segment. On the other hand, the number of cervical vertebræ in the mammal forms one of the most uniform and constant skeletal characters of the class. The few exceptions only serve to accentuate the uniformity of the rule. I think that this fact can only be interpreted by assuming that the present cephalic limit of the mammalian thorax is phylogenetically very old. That occasional cervical vertebræ bearing free ribs should occur, as reversions to the common ancestral vertebrate type, is not surprising. I cannot believe, however, that these indicate progressive reduction of the cephalic extremity of the thorax in anything like the way in which the reciprocal variations at the thoraco-lumbar junction must be regarded. Even, however, if we assume a thoracic regression at the cephalic end, absolutely no explanation is offered of the fact that the eparterial bronchial system in the vast majority of mammals is asymmetrical and confined to the right side. If, on account of progressive recession of the thorax, by the suppression of anterior ribs, the bilateral eparterial bronchial system underwent reduction, as assumed in Wiedersheim's hypothesis, such reduction would surely affect

right and left lung equally. I believe we will recognize the fact that it is not safe to rely upon isolated phological data for the explanation of the mammalian lung. "The question of reduction of the thoracic cavity by supression of caudal ribs is, without doubt, important in its bearings on the mechanical conditions of the respiratory tract. I believe, however, that it finds expression chiefly in the resultant variations in thoracic expansion, as governed by the different mobility and excursion of certain segments of the mammalian lung depends very largely, not upon the bronchial architecture, but upon the mechanics of the thorax in this respect. Different degrees of mobility, and the variations in excursion dependent upon the length of the individual ribs, can only result in the full development of the respiratory effect if the segments of the thoracic wall and lung correspond so as to meet the mechanical requirements. This is accomplished by the division of the lung into lobes which can adapt themselves to the mobility of the thoracic segments to which they belong."

CERTAIN RESEMBLANCES AND PECULIARITIES OF THE HUMAN BRAIN.

BY BURT G. WILDER.

Discussed by Drs. Huntington, Fish, Blake and Baker.

DR. HUNTINGTON said: "I have been considerably impressed, in listening to Prof. Wilder's most interesting paper with the importance of clearly recognizing variations in the human brain to which reversional value may be ascribed, only in the fissural pattern but in the structure of some of the internal parts. The different degrees of development and occasional duplicity encountered in the human medulla seem to me to possibly belong to this class, considering the size of the structure in many of the patterns—in addition to the Fissure—1 a

to attach considerable importance to the arrangement of the frontal fissural complex and to the superficial prolongation—seen in some of Prof. Wilder's brains—of the supertemporal fissure by apparent union with one of the lateral occipital or postparietal fissures."

DR. BLAKE said: "In reference to the Foramen of Magendie or Metapore, I have observed that the opening seems to have a constant relation to the choroid plexus of the ventricle, being situated immediately caudal to it, the plexus forming its cephalic boundary. In *Rana* and other forms where the cerebellum does not overlap the ventricle, the cephalic portion of the roof or metatele is considerably thickened and strengthened by the plexus, while the caudal portion of the roof is thin and weak, affording a premonition, if such an expression may be used, of the Metapore."

RELATION OF BRONCHI TO THORACIC WALL.

BY JOSEPH A. BLAKE, M. D., COLUMBIA UNIVERSITY,
NEW YORK CITY.

[To be published elsewhere.]

Discussed by Drs. Huntington and Wilder.

DR. HUNTINGTON said: "I am very glad that Dr. Blake has extended his investigations of the topographical anatomy of the thorax to include the surface relations of the main bronchi to the thoracic walls. Our knowledge of these relations, which are exceedingly important from the practical standpoint, has heretofore been very deficient. As a matter of fact there have been no data upon which conclusions could definitely be based, and Dr. Blake is to be congratulated upon having devised the only method which can be relied upon to furnish satisfactory and correct results. From the anatomical standpoint, I am especially impressed with the clear demonstration afforded by his radiographs of the influence of the aortal trunk upon the space disposition of the mediastinal contents, especially upon the primary curvature of the left stem-bronchus."

WHAT IS THE MORPHOLOGIC STATUS OF THE OLFACTORY PORTION OF THE BRAIN?

BURT G. WILDER.

[This paper embodies the "Anatomy" portion of the "Discussion of Biological Problems of To-day" before the American Society of Naturalists, December 29, 1897. Reprinted, with revision, from *Science*, N. S., Vol. VII, No. 162, pages 150-152, February 4, 1898.]

In view of the multitude of problems now confronting anatomists,* it has seemed to me that the present occasion may be best utilized by discussing in some detail a single topic which has, nevertheless, intimate relations with several others in anatomy and embryology, human and comparative. Most of the points are indicated upon the wall-maps exhibited.†

Stated more specifically, does *the olfactory portion of the brain constitute a definitive segment; or does it, together with the striatum and pallium, constitute merely the "dorsal zone" of a segment whose ventral zone is the "pars optica hypothalami," i. e., the region about the chiasma?*

As a basis for the consideration of this question are offered the following propositions, the validity of which each must determine for himself:

1. We must distinguish between the *potential neuromeres*, the precise number of which may not be determined for decades, and the *definitive segments*, which are convenient and natural divisions, even if not all of equal morphologic value.

* In 1894 I stated (Records of the Association of American Anatomists, sixth meeting, p. 32) that, in addition to about fifty special questions respecting each of the fifty particular cerebral fissures, there are at least one hundred general problems connected with them as a group of features of what is commonly mentioned as a single organ.

† These included diagrams of the brains of man, sparrow, turtle, *Neclurus*, *Ceratodus*, *Scymnus* (after T. J. Parker), *Chimaera*, *Polyodon*, *Petromyzon* and *Bdellostoma*: a diagram of the mesal aspect of the human thalamus, etc., exhibiting the location of the aulix ("sulcus Monroi") as first described by Reichert, together with the deflection of its cephalic half as proposed by His; and schemas representing (a) the dorsal aspect of the six definitive segments now recognized by me; viz.: Rhinencephal, Prosencephal, Diencephal, Mesencephal, Epencephal, Metencephal; (b) the same as if medially sectioned; (c) the several brain flexures, especially the diencephalic; (d) the five different topographic relations to the general axis of the brain (as represented by the olfactory crus) of the presumed psychic expansions.

2. For the determination of the segmental constitution of the brain more reliance is to be placed upon comparative anatomy and embryology than upon the structure and development of that morphologic monstrosity, the human brain.

3. The recent enactments of the *Anatomische Gesellschaft* upon this subject (B. N. A., 1895) are based almost exclusively upon the conditions in a single member of the vertebrate community, man; at best, even if they apply more or less closely to the other mammals, they constitute an example of "class-legislation."

4. When a writer employs a term in a sense other than either (a) that which is generally accepted, or (b) that in which it was first introduced, or (c) that in which it is used by other writers whose views he may be discussing, it is incumbent upon him to state explicitly the sense in which he proposes to use it.

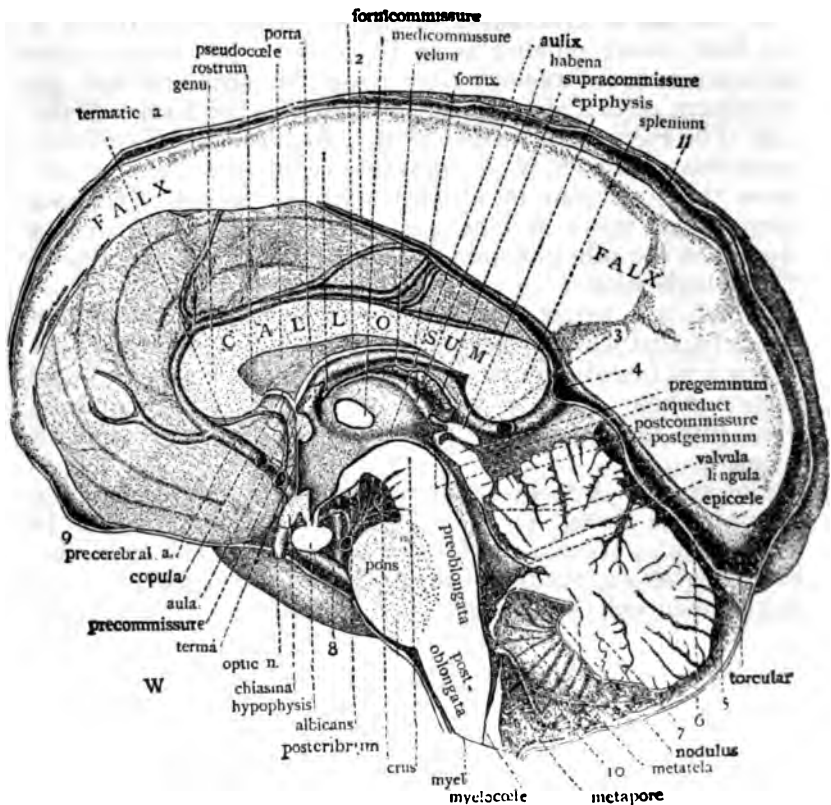
The present obstacles to the recognition of a rhinencephalic segment are three, viz.: (1) The common impression as to the insignificance of the olfactory region. (2) The existence, in the higher vertebrates, of the modification designated by me as the diencephalic flexure. (3) The adverse view adopted in the B. N. A.,* based largely upon the assumption that the region cephalad of the mesencephal† comprises dorsal and ventral zones demarcated by an alleged sulcus extending from the mesoceles toward the *recessus opticus*.‡

1. Doubtless all members of this society have discarded the anthropotomic estimate of the olfactory bulbs and their tracts as constituting merely a "first pair of cerebral nerves." But not all, perhaps, fully realize that, notwithstanding their complete absence in certain adult Cetacea, in most Mammals the olfactory bulbs are quite massive; that in Batrachians, Rep-

* Die anatomische Nomenclatur. Nomina anatomica, Verzeichniss der von der Anatomischen Gesellschaft auf ihrer IX Versammlung in Basel angenommenen Namen. Eingeleitet und im Einverständniss mit dem Redactionsausschuss erläutert von Wilhelm His. *Archiv für Anatomie und Physiologie*. Anat. Abth., supplement Band, 1895. O, pp. 180; 27 Figs., 2 plates.

† *Mesencephalon* and *mesoceles* are the English forms (Angloparonyms) of the Latin *mesencephalon* and *mesocoelia* respectively, after the analogy of *organ* from *organon*, *aqueduct* from *aquaeductus*, etc. Similarly the Latin *pericarpium* and *hippocampus* are regularly Anglicized as *pericarp* and *hippocamp*.

‡ The original and as printed in *Science* the words after *sulcus* were "the mesoceles with the *recessus opticus*." The change is made void possible injustice to those who entertain the view in question.



Mesal aspect of the right half of an adult human brain; No. 376 in the Museum of Vertebrate Zoology, Cornell University; $\times .65$.

This is Fig. 418 of the writer's article "Meninges" in the Reference Handbook of the Medical Sciences, Vol. IX, 1893. It is reproduced as Fig. 63 in C. K. Mills' "The Nervous System and its Diseases," 1898. On a larger scale it constitutes Fig. 4711 in the article "Brain; Macroscopic Anatomy," in Vol. VIII of the same "Handbook." The original was published as Fig. 1 of a paper on "Encephalic Nomenclature," *N. Y. Med. Jour.*, March 21 and 28, 1885, with an enlargement of the diencephalic region in Fig. 3. The curved white line about midway between the callosum and the fornicommissure is due to an error; the surface of the hemiseptum forming the lateral wall of the pseudocoel should be uniformly shaded. In all the compounds of *coel* the *oe* should be replaced by *e*.

Points illustrated.—The aulic ("aulic Monroi") is represented by the shaded curved line just terminates at the human brain this sulcus the chiasma figure

the medial medcommissure; it clearly is not a deflection or continuation of the sulcus; the angle between the sulcus and the medcommissure is in the angle between the sulcus and the medcommissure but is not named in the figure

tiles and most Selachians they constitute a large proportion of the brain ; and that in lampreys and hags they equal in size "the cerebral hemispheres."

Had the study of the vertebrate brain begun with Myxine or Bdellostoma the olfactory bulbs would have been unhesitatingly assigned a rank at least equal to that of either of the three following subdivisions.

Whatever the ontogeny in a given case, it is probable that phylogenetically the smelling portion of the brain preceded the reflective.

"The revolution, so to speak, of the 'hemisphere' about the olfactory axis accords with other considerations which have led Spitzka and the writer independently to consider the prevailing idea that the olfactory lobes are mere appendages of the cerebrum as nearly the reverse of the truth."*

2. The Diencephalic Flexure. With Reptiles, Birds and Mammals, the forms with which most anatomists are more familiar, the first (cephalic or "anterior") of the series of cavities seems to be the "*ventriculus tertius*"; indeed, in some Birds and Mammals the recess at the root of the optic nerve actually lies farthest cephalad. This condition seems to be associated with the general crowding of the cerebrum dorsad and caudad over the other parts of the brain. It is discussed briefly in the *American Association Proceedings*, 1887, 250-251; *American Naturalist*, October, 1887, 914-917; Reference Handbook of the Medical Sciences, VIII, 112, and *Journal of Comparative Neurology*, VI, 128.

The following propositions seem to me warranted by the conditions in Batrachians and "fishes":

However numerous or sharp the dorsoventral flexures of a given brain, for comparison with other brains or with an ideal schema the axis is to be regarded as straight.

Whatever its actual position, the aula or mesal space between the two portas ("foramina of Monro") constitutes the cephalic member of a longitudinal series of cavities.

From the standpoint of comparative neurology the terna ("*lamina terminalis*") is a constituent of the floor of the encephalic cavities; its dorso-ventral position in Reptiles, Birds and Mammals no more converts it into a morphologic end-wall of those cavities than its dorso-caudal inclination in certain forms entitles it to be interpreted as a portion of the roof.

* The Dipnoan Brain, *American Naturalist*, June, 1887, p. 546.

3. In order to be entitled to rank as a definitive segment must a given region exhibit the dorsal and ventral zones of His?

Conceding, for the present, the constancy and significance of these zones in the myel (spinal cord) and in the brain as far as the cephalic orifice of the mesocele ("aqueduct"), are they represented in the region beyond?

In the absence of complete developmental and histologic evidence on that point, my provisional answer in the negative is based upon two very different considerations:

First, the general distinctions between the parts derived from the first encephalic vesicle and the rest of the cerebrospinal axis. *Secondly*, the unsatisfactory presentation of the subject by those who attach most importance to it.

In 1859 and 1861 Reichert described and figured (Der Bau des menschlichen Gehirns, Plates II, X, XI, p. 65, line 5) a furrow on the mesal aspect of the thalamus, connecting the "aqueduct" with the porta or *foramen Monroi*. To this he applied the name *sulcus Monroi*, which has been generally employed. In 1884 the mononym *aulix* was proposed by me, and the feature has been shown distinctly in the *New York Medical Journal*, March 21, 1885, p. 327, and *Reference Handbook*, Vol. VIII, p. 122, and IX, Fig. 418, reproduced herewith.

In his exposition of the schema adopted by the *Anatomische Gesellschaft* (B. N. A., pp. 157-159) Professor His insists upon the great morphologic significance of the dorsal and ventral zones, and of the "*sulcus limitans ventriculorum*"* by which they are demarcated. He further declares that the continuation of this sulcus is the *sulcus Monroi*. But his figures represent the sulcus as terminating, not, as with Reichert, at the *foramen Monroi*, but at or near the optic recess, and, without explanation of the radical deflexion, he says, "Die Sulci Monroi laufen jederseits im *Recessus opticus* aus." The confusion caused by this unspecified transfer of a title to a different feature is augmented by the account of the same matter by C. S. Minot in the *Popular Science Monthly*, July, 1893; here the text is explicit as to the importance of the sulcus and its termination at the *foramen Monroi*; but the figure represents the boundary between the zones at a point farther caudad.

*For this I have proposed the more definite *ter zonalis*.

In this connection it should be stated that the recent studies of Mrs. S. H. Gage upon the embryo cat, turtle, batrachian and bird (*Amer. Nat.*, October, 1896, 837) have revealed sulci having various directions, but not, apparently, demarcating the dorsal and ventral zones.

In view of the present aspect of the case, while I see no impossibility in the representation of the dorsal and ventral zones in the first three segments of the brain,* and while such zones might well be demarcated by the furrow originally described by Reichert as "*sulcus Monroi*" (my *aulix*),† I hold that the interpretation of the olfactory portion of the brain as merely one part of the dorsal zone of a segment must be supported by something more than the designation of a limiting sulcus which is apparently either non-existent or without interzonal significance.

A CRANIO-MANDIBULAR INDEX.

BY CHAS. H. WARD, ROCHESTER, N. Y.

During the past two years, while working at intervals on collections illustrating human and comparative odontology, the lack of an index which should indicate the vigor and strength of the jaws in the various groups of mammals, and particularly, in the different races of men, made itself felt. That the innumerable varieties of the facial angle, while professedly giving the proportion of face to cranium, failed in this particular as they do in indicating comparative mental development, is clear.

The greyhound, a clever dog, is much further removed from the ideal angle of 90 degrees than is the pug, who is undoubtedly less intelligent. On the other hand, the edentulous ant-eater (*myrmecophaga jubata*), reveals, by the testimony of the facial angle, a far greater preponderance of face; in other words, of jaws over cranium, than does that animated bone-crusher, the hyena.

Having discovered that comparisons of bones *by weight*

* Namely, rhinencephal, prosencephal and diencephal. The limits of these as compared with the divisions recognized in the B. N. A. may be seen in the Tables on pages 45-47.

† present view the aulla and the two portas represent the prosocle and rhinocle, and the *sulcus interzonalis* in the lateral extensions.

were most useful in rapidly determining the right or left-handedness of a human skeleton—the weights of the two clavicles, or humeri alone, revealing the more functional limb more readily than does the tape-measure or the callipers—a similar method occurred to me by which *the proportional development of the lower jaw to the cranium* could be ascertained, namely: weighing the skull and jaw separately, and solving the proportion.

Wgt. of skull : wgt. of jaw :: 100 : x ; x will be the desired index. It is the percentage of jaw to skull, the skull-weight being understood as 100. In practice we multiply the wgt. of jaw by 100 and divide by wgt. of skull.

I call this the Cranio-mandibular index. As yet no arbitrary divisions of this index have been designated; the limits of such groups as seem natural can only be determined after a large number of indices shall have been taken.

Without an appeal to facts, it is entirely uncertain whether 3 or 5 or 20 divisions will give us a natural classification, or, indeed, whether nature has used any such constant proportion of parts in her cranial architecture as shall admit of a classification at all.

In taking this index certain conditions are requisite. Thus, both skull and jaw should have been cleaned by the same process, and both together, that the proportion of organic to inorganic matter shall be identical in each part. The skull with its jaw should be adult, perfect and possessed of a complete denture. If teeth have been lost *postmortem*, a like number of teeth of the same kinds and sizes can be put in the balance with the part to be weighed. If, however, teeth were lost during life and their alveoli are more or less absorbed, the addition of the missing teeth will not give the exact weight desired. Inferior turbinated and lachrymal bones, so frequently missing from macerated human skulls, may also be replaced by corresponding parts of suitable size. The human skull, unfortunately, seldom presents the complete denture so necessary to the accuracy of this index. As nearly all of my weighings have been restricted to practically perfect skulls, the indices are not as numerous as is desired. At the same time I believe them to be fairly representative, as far as they go, embracing large and small, thick and thin, microcephalic and megacephalic skulls. In all, thirty whites, one American negro, nineteen aborigines, seven anthropoids and forty-three

quadrupeds (carnivores and ungulates) have been measured to date, while the number rejected runs into the hundreds.

For a large number of these weighings, I am indebted to Mr. Ira C. Wile, of the University of Rochester, N. Y.

The six Malay indices, for example, were the only perfect dentitions, found in a search among several hundred of the skulls in the Morton Collection in the Philadelphia Academy of Sciences.

Before any of these indices had been compared, I believed that the white race would prove to have lighter jaws proportionally than savages, that the jaw grew faster than the cranium during fetal life and childhood; that woman's jaw was proportionally lighter than man's; and that, on the approach of edentulous senility, the index of the jaw would be found to revert, as does its angle, to that of childhood. Furthermore, it seemed unquestionable that the Carnivora would give higher indices than the Ungulates. Beginning with the white fetus of 5-6 months, the index is 6.2; a child 3 months old, index 8.9; a child 9 months old, index 9.9. Of white males, nearly all of whom were Europeans, I present the indices of eighteen skulls (see Table I).

WHITE MEN.—TABLE I.

Locality.	Weight in grams.		Index.
	Skull.	Jaw.	
New York State.....	765	76	9.9+
Vienna	1,060	134	12.6+
"	738	109	14.7+
Europe (mainly Austria).....	768	96	12.5+
"	600	68	11.5
"	562	68	12. +
"	680	82	12. +
"	602	70	11.6+
"	830	83	10
Buda Pesth.....	595	74	12.4+
"	555	87	15.6+
"	616	73	11.8+
"	729	85	11.6+
"	515	56	10.8+
"	562	84	14.9+
"	902	120	13.3+
"	674	68	10. +
"	578	68	11.7+
Mean Index of 18 male skulls.....	...	...	12.16
Mean weight of jaw.....	...	83.4—	...
Mean weight of skull	685.+	...	...

These range from 9.9 to 15.6, the mean being 12.16+; mean weight of skull, 685+ grams; of jaw, 83.4 grams. Of seven white women the indices varied from 13.1 to 15.5, the mean being 14.1; mean weight of skull, 500 grams; of jaw, 70.4 grams.

WHITE WOMEN.—TABLE II.

Locality.	Weight in grams.		Index.
	Skull.	Jaw.	
Europe.....	491	67	13.6
".....	445	63	14.2
" (microcephalic).....	442	64	14.5
".....	390	55	14.1
".....	521	81	15.5
".....	570	75	13.1
".....	641	88	13.7
Mean index, 7 female skulls.....	...	...	14.1
Mean weight of jaw.....	...	70.4	...
Mean weight of skull.....	500	...	...

While absolutely lighter by 13 grams than the male jaw, the index is seen to be much higher. In fact, but three male indices exceed the lowest female index. It seems proven, then, that the female of our race has a larger jaw proportionally to her skull than has the male. Two edentulous white males gave indices of 7.8+ and 7.4+ respectively, or nearly the proportion at birth. The gradually increasing proportion of the jaw to skull, from the fetus to the adult, is followed by a recession in old age, due to absorption of the alveoli.

The nineteen aborigines include seven American Indians, one African and one American Negro, five Australians and six Malays, all males, and all with beautifully perfect teeth. Their indices range from 11.6 to 19.1, mean index, 15.6. These natives were of various degrees of culture, and will prob as a fair sample of the aborigine the world

ABORIGINES. MEN—TABLE III.

Race.	Weight in grams.		Index.
	Skull.	Jaw.	
Flathead Indian.....	591	80	13.5
Pueblo ".....	570	75	13.1+
" ".....	646	94	14.5+
Coast " California.....	660	94	14.2+
" " ".....	618	80	12.9+
" " ".....	756	103	13.8
" " ".....	652	80	12.3
African, Fan tribe.....	649	91.5	14.1
American Negro.....	822	145	17.6
Australian, N. W. Coast.....	560	87	15.5
" " ".....	765	128	16.7
" " ".....	517	79	15.2
" " ".....	771	90	11.6
" vicinity of Cooktown.....	695	113	16.2
Malay, Id. of Amboyna; Morton Coll.....	836.5	99.+	11.8
" Javanese " ".....	602.5	95.7	15.8+
" Ballinese " ".....	666.+	127.5+	19.1+
" Madurise " ".....	613.+	113.5	18.5—
" Id. of Amboyna " ".....	584.7+	92.1+	15.7+
" " ".....	552.8	77.9+	14.1+
Mean index of 19 skulls of male aborigines, .....	...	...	15.6—
Mean weight of jaw.....	...	102.4—	...
Mean weight of skull.....	690.9	...	...

Taking the lowest race alone, of the five Australians the mean index is 15.04, and this although one presents an index of only 11.6, or lower than the average white male. The mean weight of jaw for all the aborigines is 102.4 grams as against 83.4 grams for white men, a superiority in weight of the savage's jaw of 19 grams. The mean weight of skull is, for aborigines 690.9 grams; for white men, 685+ grams. The savage, therefore, has a much heavier jaw joined to a skull about equal to the white's in weight, and presents, as a rule, a higher cranio-mandibular index.

A nearly edentulous Coast Indian of California gave an index of 8.2, or slightly higher type than the senile white man. Curiously enough, the heaviest skull weighed was that of a European white (1,060 grams), while the heaviest jaw (145 grams) was owned by an American Negro. The highest index is 19.1, in a Ballinese, the jaw reaching nearly one-fifth of the skull weight. Unfortunately, no skulls of female ab-

origines were found sufficiently perfect to compare with the males. Turning now to the anthropoid apes, I present the indices of 2 ♂ and 2 ♀ gorillas, 2 ♂ orangs, and a gibbon. The indices for the female gorillas are 45.9 and 46.7, the male indices being 45.3 and 44, the latter figure being, by the way, the index of the very large male skull in the Museum of Cornell University. Here again, while the male jaw is absolutely heavier than that of the female, as compared with the skull it is proportionately lighter. The male gorilla skulls will be noticed to average a trifle heavier than either white or aboriginal men while the skulls of the female gorillas are lighter than the average for white women. Two male orangs gave indices of 57.2 and 50.6 respectively, while the index of the gibbon, sex unknown, is 33.7.

ANTHROPOID APES.—TABLE IV.

Name.		Weight in grams.		Index.
		Skull.	Jaw.	
Gorilla,	Sex.			
"	♀	411	187	45.9 +
"	♀	488	228	46.7 +
"	♂	698	316	45.3 +
"	♂	765	336.5	44
Simia satyrus,	♂	451	258	57.2 +
"	♂	405	205	50.6
Hylobates,	?	37	12.5	33.7
Mean index of 7 anthropoids.....		...	...	46.2

The accompanying table of indices of carnivora discloses a greater uniformity of index, for a given species, than is found in man; and, although the limited number of measurements taken is not conclusive, yet the evidence goes to prove that this uniformity becomes still more marked as we turn from the domesticated to the wild species. Thus, while of the eight dogs measured, the index varied from 45 to 57.8, or 12.8 per cent., in eleven foxes it ranged only from 46 to 52.8, or 6.8 per cent. The domestic cat, with an index of 35, shows a degeneration in ~~vomer of jaw~~ as compared with the wild cat, with a mean ~~mens~~ of 41, that is probably a result of ~~in man~~. A considerable jump is ~~where the index in the two~~ 5.4; sex of these unknown.

CARNIVORES.—TABLE V.

Name.	Weight in grams.		Index.
	Skull.	Jaw.	
<i>Canis familiaris</i>	189	109	57.6
" ".....	146	80	57.8
" ".....	162	70	45
" ".....	165	82	49.7
" ".....	350	165	47.1
" ".....	103	49	47.5
" ".....	144	67	46.5
" ".....	96	44	45.9
<i>Mean index of 8 dogs 49.6</i> +.....	...	...	...
<i>Canis fulvus</i>	42	22	52.4
" ".....	42	21	50
" ".....	37	17	46—
" ".....	44	22	50
<i>Canis lagopus</i>	40	20	50
" ".....	51	26	50.9 +
" ".....	32	16	50
" ".....	36	19	52.8
" <i>vulpes</i>	78	40	51.3
" (<i>fox. sp.</i>).....	48	24	50
" ".....	54	28	51.8
<i>Mean index of 11 foxes, 50.5</i>.....	...	...	...
<i>Canis occidentalis</i>	300	165	55
" ".....	261	150	51.5
<i>Felis leo</i>	657	364	55.4
" ".....	562	266	47
" <i>rufa</i>	49	20	40.8
" ".....	66	27	40.6
" ".....	72	29	40
" ".....	52	21	40 +
" <i>domestica</i>	20	7	35
" ".....	28	9	35.6
" <i>planiceps</i>	27	11	45.8
<i>Mean index of 30 carnivores</i>.....	...	...	47.9 +

Here again the weight of the cranium is about that of man's, being higher than the mean for white women and lower than that for men. But the jaw is about four times as heavy as civilized man's, or about equal to the male gorillas. Thus far, the highest index met with among carnivores is 57.8 in a dog. Turning finally, to the ungulates, it will be observed that only two of the thirteen indices taken are below this figure. The pig, horse, tapir, rhinoceros, several deer, the alpaca, dromedary—even the females of the domesticated

sheep—all have jaws heavier in proportion to the skull than does the lion. The single dromedary specimen weighed presents the remarkable index of 80.

UNGULATES.—TABLE VI.

Name.	Weight in grams.		Index.
	Skull.	Jaw.	
Ovis aries domestica, Sex. ♀.....	260	161	61.9
“ “ “ “ “ “.....	247	149	60.3
“ “ “ “ “ “.....	253	149	58.8
Camelus arabicus.....	1,742	1,458	80.4
Auchenia pacos.....	220	150	68.1
Sus scrofa.....	692	446	64.5
Sus barbatus.....	912	660	72.3
Moschus moschiferus.....	39	21	53.9
Alces machlis, Sex. ♀.....	1,037	619	59.7
Tragulus javanicus.....	24	18	75
Equus caballus.....	2,121	1,445	68.1
Elasmognathus bairdi.....	1,656	941	56.7
Rhinoceros sp.....	4,300	2,690	62.6
Mean index of 13 Ungulates.....	...	...	64.8

This, briefly, is the record to date of my cranio-mandibular index. That it gives a proportion hitherto entirely ignored, yet of real importance, and that, unlike most cranio-metrical processes, it is equally applicable to the lower vertebrates as to man, is my defense for adding one more to the already formidable array of cranial indices.

The paper was discussed by Prof. Gage.

THE MORPHOLOGY OF THE APE CEREBELLUM.

BY BERT B. STROUD, D. SC., ITHACA, N. Y.

On account of the zoologic position of the apes, a great deal of interest attaches to the various features of their anatomy.

Material.—The material upon which this paper is based comprises the well preserved cerebellums of five apes in the museum of Cornell University, viz: No. 265. Young female chimpanzee. No. 2,548. Young female orang. No. 3,638. Young female orang. No. 3,733. Young female orang. No. 3,561. Young male gorilla.

It is to be regretted that no specimen of *Hylobates* is available for examination.

I wish to express my indebtedness to Professor B. G. Wilder for valuable suggestions.

Figure 1 is a diagram intended to display the subdivisions of the human cerebellum. It shows the cerebellum as if expanded so that three views, dorso-cephalic, dorso-caudal, and lateral appear as if in one plane.

Omissions.—1. The line from the elongated mass lying between the flocculus and the cacuminal lobe should be continued to the word *paraflocculus*. 2. The sulcus caudad of the cacuminal lobe should be labeled *peduncular sulcus*.

It shows:

1. The mesencephal, comprising pregeminum, postgeminum, and crura.

2. The prepeduncles, between which is the thin valvula. Compare Fig. 1, Plate 1.

3. The cerebellum proper, comprising the large, sub-quadrangular, lobulated, mesal mass, pilea and vermis; and two pair of lateral masses the flocculus and paraflocculus, separated from the mesal mass by the floccular and parafloccular sulci. The mesal mass comprises nine foliated lobes separated by eight sulci.

4. The relations of the caudal border of the cerebellum to the metatela, metaplexus, metapore, and metacele.

The morphologic relations of these parts, clearly apparent in the green turtle, *Chelone midas*, and in early mammalian forms, are obscured in the adult mammal by the great expansion of the parts just cephalad. If the uvular lobe

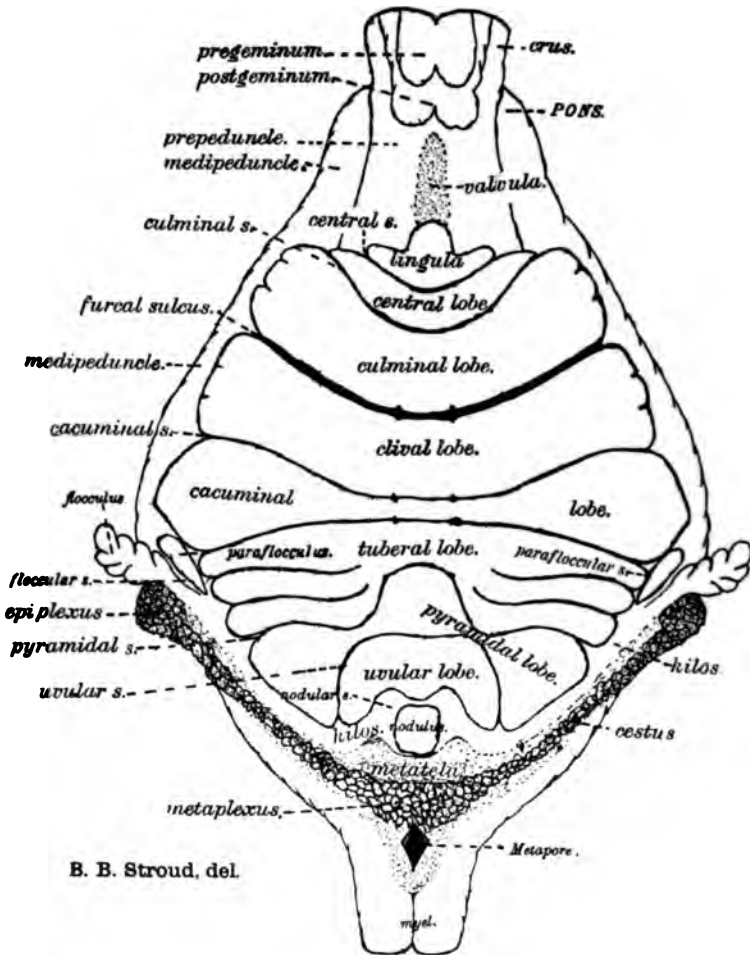


Fig. 1. Diagram showing the divisions of the human cerebellum.

and parts of the pyramidal lobes are cut away, or if, in a fresh specimen, they are tilted cephalad, the true relations may be readily determined. They are :

- a. The transition from the **substantial** roof to membranous nervous substance, the kilos (*Rautenlippe*) extends from the side of the cerebellum from the other side. It is wider than the *nidus avis*.

TABLE I.

The following table indicates the divisions of the vermis and pilea recognized by the writer. Also the names applied to the corresponding parts by others.

Terms preferred by the writer		Schäfer	Various authors
VERMIS	VERMIS AND PILEUM	WORM AND HEMISPHERE	HEMISPHERE
PREVERMIS			
1. Cephalic lobe, (Lingula?), <i>variable</i>	1. Lingular lobe	Lobus lingulae 1. Lobus centralis	Fraenum lingulae Ala lobuli centralis
2. Central lobe	2. Central lobe	2. <i>Not recognized as a distinct lobe</i>	
3. Culmen	3. Culminal lobe	3. Lobus culminis	Lobus lunatus anter. Anterior crescentic lobe
Furcal sulcus			
POSTVERMIS			
4. Clivus	4. Clival lobe	4. Lobus clivi	Lobus lunatus poster. Posterior crescentic lobe
5. Cacumen	5. Cacuminal lobe	5. Lobus cacuminis	Lobus postero-super. Presemilunar lobe
6. Tuber	6. Tuberal lobe	6. Lobus tuberis	Postsemilunar lobe Lobus postero-infer.
	a. pretuberal lobe	.....	a. L. semilunaris inferior
	b. mediotuberal lobe	.....	b. Slender lobe L. gracilis posterior
	c. posttuberal lobe	.....	c. L. gracilis anterior
7. Pyramis	7. Pyramidal lobe	7. Lobus pyramidis	Cuneiform lobe L. biventralis
8. Uvula	8. Uvular lobe	8. Lobus uvulae	Tonsilla Tonsil Amygdala
9. Nodulus	9. The nodulus does not extend laterad into the pileum The flocculus is a separate division. It is <i>not</i> a part of the pileum (or hemisphere)	9. Lobus noduli	Flocculus

b. Just caudad of the cerebellum the metepicele widens so that there is a narrow lateral extension upon each side to the lateral border of the oblongata. These extensions constitute the lateral recesses of the cerebellum.

c. The metatela encloses the metacele and the lateral extensions.

d. From the metatela is developed an extensive plexus having the general extent indicated in the diagram. The mesal part is the metaplexus; the ends of the plexus constitute the epiplexus.

e. The line of attachment for the plexus, more apparent in the embryo, is the cestus.

f. The metapore ("foramen of Magendie") is located in the caudal angle of the metatela.

TABLE II.

The following table shows, in the first column, the terms preferred by the writer for the cerebellar sulci. The second column gives the terms employed by Professor Schäfer.

Sulci (the writer)	Sulci (Schäfer)
1. Central sulcus	1. Sulcus precentralis
2. Culminal "	2. " postcentralis
3. Furcal "	3. " preclivalis
4. Cacuminal "	4. " postclivalis
5. Peduncular " (Wilder)	5. " horizontalis magnus
	<i>a.</i> Sulcus postgracilis
	<i>b.</i> " intragracilis
6. Pyramidal "	6. " pregracilis
	<i>s.</i> postpyramidalis
7. Uvular "	7. " prepyramidalis
8. Nodular "	8. " postnodularis

Ectal features.—In ectal form and appearance the ape cerebellum is practically identical with the human organ. And at first sight the most striking feature is its great resemblance. Yet there are marked discrepancies in outline, or in the prominence of certain regions. Closer inspection, however, leads to the or they are merely differences in degree of develop-
ment

an organ, the ape cerebellum presents the ar-
t separated by sulci. An idea of the depth of
best obtained from sagittal sections, or at

least a mesal section. The depths of the sulci and the proper division of the general mass into lobes cannot be ascertained from the inspection of the ectal features alone. It will be convenient to consider the entire organ as, in sagittal section, a subtriangular mass, with the apex pointing dorsad. In primates *only*, it is divided artificially, but not morphologically, into a dorso-cephalic and a dorso-caudal slope. Of these two slopes the cephalic is the less abrupt, and includes the preramus and the clivus and cacumen of the postramus. The dorso-caudal slope is much more abrupt. It comprises the remainder of the postramus.

The dorsal aspect.—There appear from the dorsum :

1. The vermis, mesal.

2. The two pilea, lateral ; (lobi laterales or "hemispheres.")

The flocculi and paraflocculi, visible from the dorsum in the lower primates, have been crowded ventrad and entirely concealed by the enormous lateral development of the pilea. They appear only in a lateral aspect.

The vermis.—This comprises a series of mesal folia, the branches and branchlets of the arbor, continuous upon the right and left with lobes of the pilea. Each lobe of either pileum has a corresponding lobe in the opposite pileum. Normally the two are continuous through the vermian folium. There is, however, in different specimens, some variation, due to irregularities in the formation of sulci ;* *i. e.*, a given lobe

C	—	—	C'
A	—	—	A'
B	—	—	B'

may be continuous with its opposite or with a lobe cephalad or caudad of its opposite.

For example, A may be continuous with A', or with B' ; or with C'.

In all the specimens examined, the vermis from the culmen to the pyramis is elevated slightly above the adjacent surface. In No. 3,561, gorilla, and 3,638, orang, it is demarcated by a shallow, interrupted, cephalo-caudal furrow. In 3,733, orang, and 265, chimpanzee, and 2,548, orang, there is no apparent demarcation. A similar tendency to variation is found in man. The caudal portion of the vermis (*i. e.*, tuber, pyramis,

* See statement regarding the development of sulci in man, Proceedings of the Association of American Anatomists, May, 1897, p. 21.

uvula, and nodulus) is separated from the general mass upon each side by the deep vallecule. Thus the lateral connection with the folia of the pilea is obscured.

The pilea.—Viewed from the dorsum, the subspherical pilea (lateral hemispheres) resemble quite closely those of man, but they differ in the relative development of certain constituent lobes. There is apparently, the same subdivision into lobes and folia, but the individual lobes are not so robust as in man.

Upon the dorso-cephalic aspect the mesal portion projects abruptly cephalad, and the lateral surfaces are more or less depressed to near the lateral border, where the surface rises again as it approaches the edge.

The cacuminal lobe (presemilunar lobe Wilder).—The cacuminal and peduncular sulci bound two wedge-shaped masses which are united at the meson by the thin, in man, cacumen. These masses constitute the extreme dorso-lateral portions of either pileum and form the apex of both the dorso-cephalic and dorso-caudal slopes. These two masses, together with the cacumen, form the *lobus cacuminis* Schäfer (lobus postero-superior). If the lips of the cacuminal and peduncular sulci are divaricated, it will be seen that each wedge-shaped mass consists of a central plate thickly beset with folia which radiate therefrom.

The remainder of the cephalic slope (*quadrangular lobe Wilder*) is simple. It comprises two general regions. (a). That bounded by the furcal and cacuminal sulci constituting the clivus and its lateral extensions, the clival lobe (*lobus lunatus posterior*) (*lobus clivi* Schäfer). As a whole it has the form of a broad, thick crescent, and is formed from two thick lobes which bear folia.

(b). *The culminal lobe.*—The remaining cephalic portion of the cerebellum visible from the dorsum, constitutes the major part of the praeamus. In general form it resembles the clival lobe and includes the three main branches of the culmen (*lobus lunatus anterior*), (*lobus culminis*, Schäfer).

The dorso-caudal slope is much more complex in its structure and relations. All of the surface visible from the dorsum comprises two lobes, themselves subdivided, the tuberal and obes. The lateral limit of these lobes is the floc-

A tonsilla (uvular lobe) is present, but does not orsal view.

! lobe (*lobus semilunar inferior*), (*postsemilunar*

lobe. Wilder).—The thin submerged tuber expands laterad to form a large, foliated, crescent-shaped lobe. It is bounded, cephalad by the peduncular sulcus; caudad by the pyramidal sulcus; laterad by the floccular sulcus.*

The pyramidal lobe (lobus biventralis), (lobus pyramidis Schäfer).—The pyramis extends laterad and caudad as an ovate lobulated mass. It is bounded cephalad by the pyramidal sulcus; laterad by the floccular sulcus; caudad by the uvular sulcus. The mass is roughly divided into three foliated lobules. The first and second lobules are narrow, crescent-shaped, and composed of a few thin lamellae. They resemble the lobus gracilis anterior (*slender lobe* Wilder) and lobus gracilis posterior of the human organ. The caudal division is an oblong mass divided into numerous thin lamellae. It resembles the pyramidal lobe (*lobus biventralis*) in man. In the apes examined, all three lobes are the lateral extension of the pyramis. In man, usually what appear to be the two cephalic lobes are joined to the tuber, and the caudal one alone to the pyramis. But one human cerebellum, No. 3,546, presents the same condition as that of the chimpanzee, 265, described above.

The uvular lobe (tonsilla), (amygdala), (lobus uvulae Schäfer).—The lateral continuation of the uvula is a relatively small tetragonal mass wedged in between the pyramidal lobe and the oblongata. It is bounded cephalad by the uvular sulcus; laterad by the floccular sulcus; caudad by the cephalic border of the kilos. It does not appear in a dorsal aspect as in man, but only in a mesal view.

The nodulus forms the extreme caudal lobe of the vermis. It is a small tetragonal mass cut by folia running from right to left. It lies at the meson, concealed by the uvula, and wedged in between the uvula, the two tonsillae, and the epi-cele. There are no lateral masses extending out into the pileum as in the case of the other vermian branches. Whether

*On account of variations in its constituent lobes, the tuberal lobe, in man at least, is likely to be the source of considerable misapprehension. Future specimens of ape cerebellums may show a similar variation in them; Professor Schäfer includes under the name *lobus tuberis*, three lobes, viz.—

1. Lobus semilunaris inferior,
2. Lobus gracilis posterior,
3. Lobus gracilis anterior.

This appears to be the usual condition, but some human cerebellums show a great variation; No. 3,546, Museum C. U., exhibits a condition practically identical with that of the chimpanzee, No. 265.

or not cinerea extends from the nodulus upon the kilos must be determined by a histologic examination.

The lateral aspect.—Three general regions can be distinguished:

1. The *vermis*, the dorso-cephalic part of the cerebellar mass.

2. The *pileum*, forming the largest visible part of the organ. The general surface slopes from the vermis latero-ventrad to the lateral border. The most prominent feature is the large wedge-shaped lateral extremity of the cacuminal lobe; caudad is the rounded surface of the pyramidal lobe.

3. The *flocculus*, a small foliated mass lying in a notch of the pileum, between it and the oblongata.

The Flocculus.—It is a small triangular foliated mass which arises as a pear-shaped lobe from a narrow base. It extends laterad and appears to lie loosely upon the latero-caudal surface of the medipuncle. But if the ends of the overhanging folia of the pyramidal and uvular lobes be crowded aside, it will be seen that the flocculus has a substantial connection with the underlying nerve substance and that it is separated from the ends of the pilear folia by a deep sulcus, the floccular sulcus.

The flocculus forms the caudal and morphologically lateral limit of the epicellic roof. A thin, narrow edge of nervous substance, the *kilos*, extends from its caudal border as far laterad upon the flocculus as the apparent origin of the eighth nerve. It soon merges into the metatela. The caudo-ventral surface of the flocculus is covered by endyma and forms the cephalic boundary of the lateral recess of the epicle. The lateral limit of this recess is marked by the epiplexus. Fig. 2, Pl. I.

The flocculus occupies the same relative position and has approximately the same relative size throughout the entire mammalian series, except in man, where it is usually a little smaller.

The Parafocculus.—In the three apes studied, gorilla, orang and chimpanzee, the parafocculus exemplifies an interesting series—a transition from the large projecting parafocculus of the lower primates to the small, concealed and apparently vestigial lobe of man. An exception is to be noted in the case of one human cerebellum, No. 3552, where the left parafocculus is about as large as the flocculus and partly exposed.

The right side is normal. This is the only case of the kind known to me.

In imprimates, and also in the lower primates, the paraflocculus is larger than the flocculus and very conspicuous. It is bounded by two deep sulci, the floccular sulcus ventrad; dorsad by the parafloccular sulcus which separates it from the pileum.

In the gorilla, No. 3561, the paraflocculus is very large and almost entirely exposed.

In the orang, No. 3638, it is small and concealed on the left side, only the tip showing on the right side. Orang, No. 3733, shows the same condition.

In the chimpanzee, No. 265, the paraflocculus is small and concealed on the left side; the tip is visible on the right side.

THE SULCI OF THE CEREBELLUM.

The study of sulci should begin upon sagittal sections, or, at least, upon a mesal section, where their depth and presumable relative importance are more apparent; see Fig. 1, Pl. I. The course of the individual sulci can then be traced upon the ectal surface.

Inspection of the mesal aspect shows that one sulcus, *the furcal*, is deeper than any other, and divides the entire mass into two great regions.

So far as I can judge, the sulci of the ape cerebellum may properly be included within the three categories to which the human sulci have been assigned (see Proceedings of the Association of American Anatomists, May 4-6, 1897, p. 21), viz:

1. Those which appear early in development, upon the latero-caudal aspect and demarcate flocculus and paraflocculus from the pileum.

2. Those which appear at the meson, and extend themselves laterad.

3. Those of the third group belong primarily to the pileum (lateral hemispheres). Their greatest depth is upon the pileum. They usually fuse at the meson so as to form a continuous sulcus from one side of the cerebellum to the other.

The sulci extend nearly parallel and divide the general mass into foliated lobes corresponding with the main branches of the vermicular arbor. Each lobe is cut into many subdivisions and folia by sulci of less importance, which will not be considered in the present paper.

The individual branches in the cerebellum are named from corresponding lobes in the human arbor. They are separated from each other by sulci, of which some are deeper than others. For purposes of description, it will be convenient to begin with the more cephalic, and, with the exception of the *furcal* and *peduncular sulci*, to name each sulcus from the lobe which is immediately caudad of it.

The vermis contains nine primary branches (or lobes). There are, therefore, eight sulci separating these nine lobes, viz :

The central, culminal, furcal, cacuminal, peduncular, pyramidal, uvular, and nodular.

To these should be added the floccular, a deep sulcus, upon either side. See Fig. 1, and Plates I and II. It separates the flocculus from the pileum, and from the surface of the medipeduncle. It begins just dorsad of the auditory nerve, and extends dorso-caudo-ventrad, in the form of a loop to the caudal limit of the flocculus. In apes and man the paraflocculus lies for the most part concealed within the depths of the floccular sulcus.

The central sulcus.—This is a submerged sulcus, and appears only in a mesal section. It extends laterad for a short distance, and ends abruptly. It separates the central lobe from the cephalic lobe (lingula?).

The culminal sulcus.—It, like the central, is a submerged sulcus. It divides the culmen from the central lobe, and extends laterad to the mesal border of the medipeduncle, being entirely concealed by the overhanging lobes of the culmen.

The Furcal sulcus.—Lies just caudad of the culmen. It is the landmark of division between the pre- and postramus. It is the deepest sulcus that appears at the meson. It has the form of a broad U and is deepest at the meson, becoming more shallow as it extends out upon the pileum. It extends latero-cephalo-ventrad and ends in the floccular sulcus at the cephalic border of the flocculus.

The cacuminal sulcus.—Begins at the latero-cephalic angle of the flocculus and curves around in a direction caudo-dorso-mesad and usually fuses with its opposite from the other pileum. It is shallow at each end and at the meson (See Fig. 3, Pl. II.) but is very deep at about the middle of either pileum. It forms the cephalic boundary of the cacuminal lobe.

The peduncular sulcus.—Arises at a point near the origin of

the cacuminal sulcus and extends dorso-caudo-cephalo-mesad. In general features, except direction, it resembles the cacuminal. The two sulci diverge from their origin and converge as they approach the meson, thus demarcating the wedge-shaped cacuminal lobe of either pileum.

The pyramidal sulcus.—Arises just caudad of the peduncular s. and extends caudo-dorso-mesad, in the form of a crescent. It is very deep throughout its entire course. At the meson it is much deeper than either the cacuminal or peduncular sulci. It marks the division between the tuberal and pyramidal lobes.

The uvular sulcus.—Arises at the caudal angle of the flocculus and extends caudo-ventro-mesad. It is a very deep sulcus throughout but deepest on the pileum. It marks the caudal boundary of the pyramidal lobe and is concealed under the caudal part of that lobe.

The nodular sulcus.—Is a short mesal and concealed sulcus. It separates the nodulus from the uvula and apparently has no lateral extension. It appears to represent the central sulcus.

THE MESAL ASPECT.

The ectal features must be supplemented by at least a mesal section. The general appearance of a mesal section is like that of man, an obtuse, one-sided pyramid. The caudal slope is the shorter and more abrupt. The most obvious features are—

1. The expanded massive cerebellum composed of foliated lobes varying in size.
2. The oblongata and pons, essentially as in man.
3. The metepicele triangular, deep and extending around the caudal side of the medipeduncle to form the lateral recess of the epicele, which is bounded by the epitela and epiplexus.
4. The valvula, a thin folium of alba extending from the geminum to the cephalic folium of the cephalic lobe (lingula?).
5. The metatela, metaplexus, and metapore.

The roof of the metepicele obviously is composed of three kinds of material:

- a. The valvula, thin and fibrous.
- b. The huge mushroom-like cerebellum with its bifurcated arbor. The entire mass is covered with ectocinerea extending from the valvula and dipping into all the sulci and sulculi to the last folium of the nodulus. Whether cinerea extends out

upon the kilos or not must be determined from microscopic sections.

c. The thin metatela extending from the caudal folium of the nodulus to the substantial obex and perforated by the metapore. The tela bears a luxuriant plexus which extends laterad upon the caudal wall of the lateral recess to form the epiplexus.

The arbor is divided by the furcal sulcus into a preramus and postramus, each of which is subdivided into secondary and tertiary branches and folia. These are separated by sulci of more or less depth. At the meson the preramus is only slightly smaller than the postramus; but laterad the postramus becomes much the larger.

The preramus comprises one large branch, the culmen, and two smaller lobes, the central and cephalic lobes respectively.

The postramus comprises four branches, three of which extend laterad and form portions of the pileum.

Constituents of the preramus:

1. The cephalic lobe, a small, thin foliated lobe, the cephalic limit of the cerebellar ectocinerea. It is just caudad of the valvula.

2. The central lobe, same as in man, a bifurcated branch bearing folia. Both the central and cephalic lobes are concealed beneath the overhanging culmen.

3. The culmen, a large wide-spreading arm comprising four secondary branches of which the first three are visible from the dorsum. The fourth lies down in the furcal sulcus and is entirely concealed under the third lobe. The culmen is the largest and broadest branch of the preramus and forms the cephalic one-third of the entire cerebellum.

Constituents of the postramus.—1. The first and largest branch contains four smaller foliated branchlets. It rises high above the oblongata and forms the dorsal apex of the cerebellum.

The first two branchlets represent the human clivus. The third, usually very small in man, is the cacumen, here large and foliated.

The fourth, a thin corrugated folium, concealed beneath the culmen, is the tuber which in most human cerebella is well developed. This condition, a large culmen, and a small, concealed tuber, is entirely new; but I have lately found precisely the same con-

dition in a human cerebellum; see No. 965, Museum of Cornell University.

2. The second branch clearly represents the pyramis, which resembles the human structure, in all except that it is joined to a larger lobe in the pileum.

3. The third branch is the uvula, which does not differ essentially from the condition in man. Its lateral extension is much less developed than in man.

4. The fourth branch is the nodulus. It is larger than in man, and has no lateral extension into the pileum.


DIFFERENCES BETWEEN APES AND MAN.

The difference between given human and ape cerebellums may be very great; but if a large enough series of each be taken, some specimens will be found in which practically the same condition will be found to exist in both man and apes.

The ratios of the gross dimensions are about the same in each. The most striking differences in ectal features are:

1. The greater prominence of the prearmus.
2. The vermis is less clearly demarcated than in man.
3. The vallecule is more shallow.
4. The relative mass of the cerebellum is less in the apes.
5. The development of the caudal part, as a whole, is less.
6. The uvular lobe (tonsilla) is not visible from the dorsum.
7. The tuberal lobe is proportionally smaller; its form is, in the apes, crescentic, in man, triangular crescentic.
8. The pyramidal lobes are proportionally much larger in apes, and include two narrow lobes (*lobus gracilis anterior* and *lobus gracilis posterior* Schäfer), which usually form a part of the tuberal lobe in man.

The dorso-cephalic slope looks unlike the same region in man, but the difference is not easy to describe. The most prominent features are:

1. The vermis is narrower and more prominent.
2. The sulci extend from right to left in the form of a large, wide U. In man, the arms of the U are so widely separated that the sulci are approximately crescentic, thus .
3. More of the cacuminal lobes occupy the dorso-cephalic slope (or aspect) in man.
4. In man, the tuberal lobe is visible in a cephalic aspect; this is not the case in the apes.

The dorso-caudal slope.—The most apparent feature of this

region is that the entire area, in man, has a relatively greater development and the individual lobes are thicker and more prominent.

THE MESAL ASPECT.

The two rami of the arbor, at the meson, are more nearly equal in the apes. In man the preramus is relatively smaller and is crowded cephalad by the great development of the postramus.

1. The valvula is relatively thinner in man. The ectocinerea does not extend out upon it.

2. The cephalic lobe is a small foliated mass lying ventrad of the central lobe and entirely covered by it. An analogous condition is occasionally found in man, where an additional lobe is sometimes interpolated between the central lobe and the valvula; see specimens Nos. 376, 385, 729, 3118, 3682, 2084, 2279, Museum of Cornell University. I am inclined to consider the cephalic lobe as the homologue of the human lingula.*

3. The central lobe is relatively more massive in apes, being thicker and shorter than in man.

4. The culmen is relatively larger than in man. In each there are four branches, the fourth being submerged in the furcal sulcus. In man the fourth branch is usually smaller than in the apes.

5. The clivus is not so well developed as in man. It consists of two branches nearly equal in size. In man, the first branch is much the larger, and projects cephalad so as to encroach upon the culmen.

6. The cacumen is a large foliated branch. See Fig. 1, Pl. I. It appears very prominent in a dorsal aspect. The three apes examined, orang, gorilla, and chimpanzee, showed about the same condition.

The cacumen in man is usually only a thin plate of nervous substance uniting the two cacuminal lobes of the pilea. However, in one human cerebellum, No. 965, the cacumen is comparable in every way, except in relative size, with the condition found in apes.

7. The tuber is a small branch entirely submerged, covered up by the cacumen; see specimens Nos. 265, 3733. Note the contrast. The condition usually found in man, *i. e.*, in

* The lingula and its homologies will be discussed at a future meeting.

man a small cacumen and a large tuber; in the apes a large, well developed cacumen and a rudimentary tuber.

8. The pyramis resembles the corresponding lobe in man. But the pyramidal lobe of the pileum differs in the fact that it contains three lobes instead of one as in man, where the first two lobes form a part of the tuberal lobe. And the third apparently represents the biventral lobe of man.

9. The uvula resembles the human uvula; but the uvular lobe (tonsilla) is much smaller than in man and is entirely concealed under the pyramidal lobe. It appears only in a mesal aspect.

SUMMARY.

1. The ape cerebellum in form and subdivisions closely resembles the human organ.

2. The differences are mainly in the degree of development of particular regions.

3. The study of ectal features must be supplemented by the examination of at least a mesal section.

4. The arbor, and consequently the entire organ, is subdivided by the furcal sulcus into a preramus and a postramus, as in all mammals.

5. A dorsal view shows only the vermis and the two pilea.

6. The folia of the vermis are continuous with the lobes of the pilea.

7. The pilea overhang and conceal the flocculi.

8. The general mass of the organ is divided by sulci into the same lobes as in man, but some lobes are poorly developed.

9. The sulci present the same variations that are found in man.

10. The furcal sulcus, as in all mammals, forms a constant landmark.

11. The flocculus is relatively a little larger than in man.

12. The parafocculus is vestigial as in man.

13. The preramus, as sometimes occurs in man, contains an additional lobe which the writer believes to be the lingula.

14. The central lobe has the same general position as in man, but is, perhaps, relatively a little larger in the apes.

15. The dorso-caudal aspect of the organ contains the same number of lobes as in man; but the relative development and relations differ from the conditions usually found in man. See Fig. 4, Pl. II.

16. The vallecule is more shallow in the apes.

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DR. HUNTINGTON said: "I believe I share with anatomists in general a feeling of gratitude to Dr. Stroud for his indefatigable and important work on the morphology of the cerebellum. I am especially pleased at the fact that his *sulcus furcalis* is so well borne out by the handsome series of higher primate cerebella here exhibited. I note with interest his statement that he has found the lingula in the higher apes uniformly attached to the velum, and I should like to ask him in what light he regards these rudimentary transverse gyres and the corresponding hemisphere portions phylogenetically."

PLATE I.
APE CEREBELLUM.

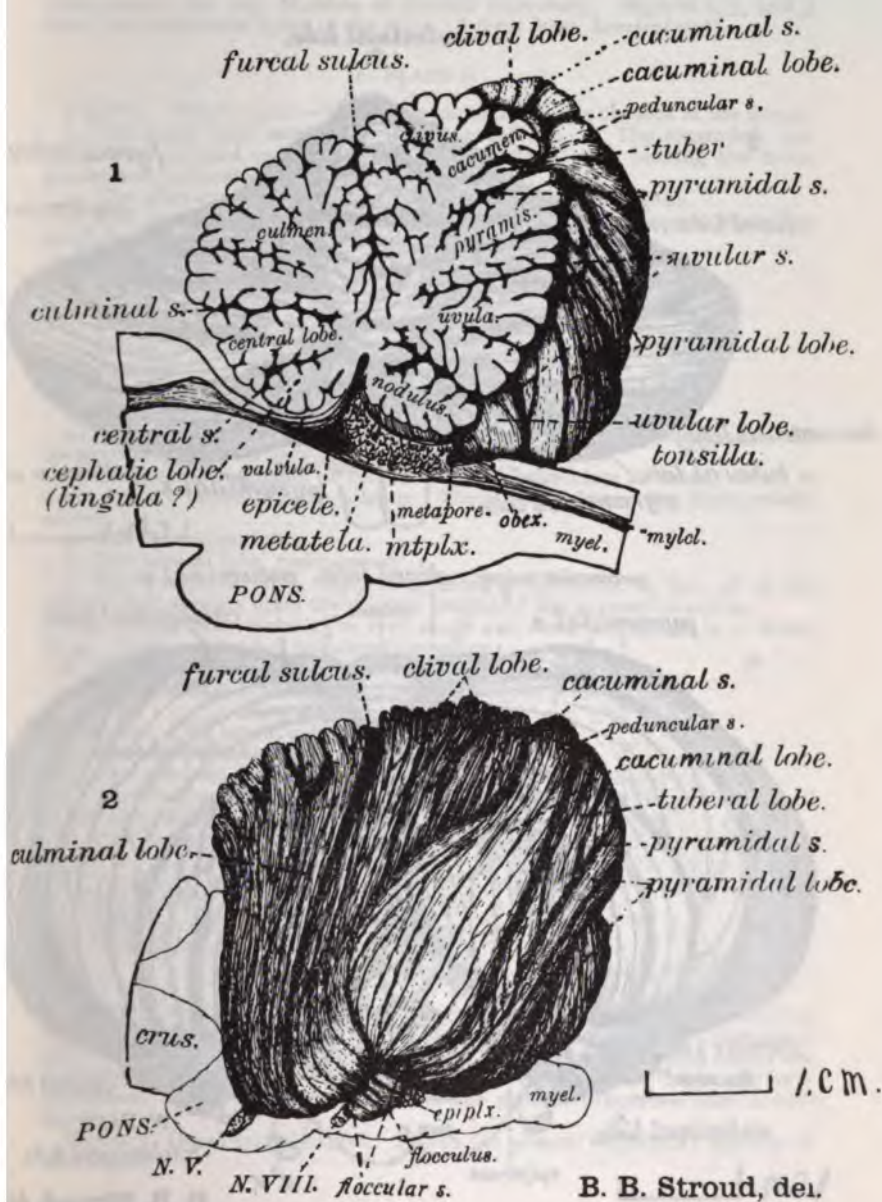
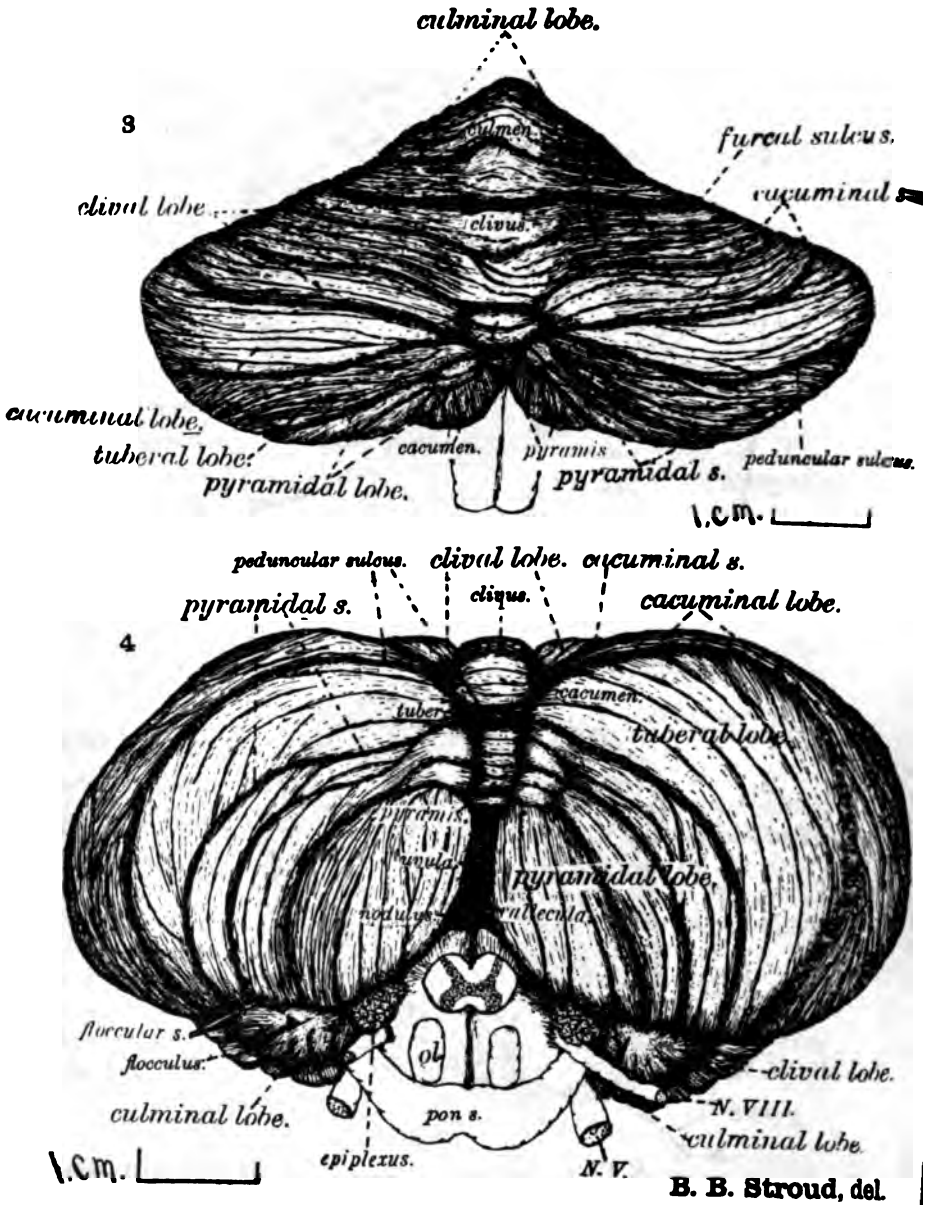


PLATE II.
APE CEREBELLUM.



DESCRIPTION OF PLATES.

Figures 1 to 4 are four aspects of the same specimen, a young female chimpanzee; No. 265, Museum of Cornell University. Figures 2, 3, and 4 show the constituent lobes of the pilea, (*lateral lobes, hemispheres*).

PLATE I.

Figure 1. Mesal aspect.—Shows the general features obvious at the meson.

1. The mesal land marks. *a.* The thin valvula. *b.* The expanded, umbrella-like, foliated cerebellum. *c.* The metatela, thin, bearing the metaplexus and perforated by the metapore.

2. The sulci apparent at the meson, and their relative depths.

3. The furcal sulcus, the deepest one. It divides the general mass into two regions, preramus, comprising three branchlets, viz :

a. Cephalic lobe (*lingula?*).

b. Central lobe.

c. Clivus.

And postramus, comprising four branchlets, viz :

a. Clivus, cacumen, and tuber—subdivisions of the same branch.

b. Pyramis.

c. Uvula.

d. Nodulus.

4. The relative mass, at the meson, of the preramus and postramus. Also the secondary and tertiary branchlets and folia.

5. The lateral extension of certain of these branchlets as lobes, which in their totality constitute the pileum. Three appear upon the dorso-caudal aspect, viz :

a. The cacuminal lobe.

b. The tuberal lobe, rudimentary.

c. The pyramidal lobe, comprising three subdivisions, in fact, all of the pileum that appears upon the dorsum caudad of the pyramidal sulcus.

The uvular lobe (*tonsilla*) is very small and does not appear in a dorsal view. The nodulus has no lateral extension.

6. The relative size of the pons, oblongata, and cerebellum.

7. The relations of the epicle and metacele.

Figure 2. Left lateral aspect. Shows :

a. The general features of this view.

b. The chief sulci, and the general lobes demarcated thereby.

c. The relative masses of the preramus and postramus. The culmen is all of the preramus that is visible.

d. The wedged-shaped cacuminal lobe and its relation to the surrounding parts.

e. The tuberal and pyramidal lobes are foreshortened. See Fig. 4.

f. The trigeminus and auditory nerves.

g. The flocculus and floccular sulcus.

h. The epiplexus, *epiplx.*

PLATE II.

Figure 3. Dorsal aspect. Shows the general features and the division into lobes by the principal sulci. In this specimen the right and left cacuminal sulci do not join. The left dodges around the cacumen and joins one of the secondary sulci of the clivus. The tuberal and pyramidal lobes are foreshortened. The characteristic form of the primate cacuminal lobe is well shown.

Figure 4. Dorso-caudal aspect. Shows the general superficial features of this region.

- a. A small portion of the caudal part of the clivus and clival lobes is visible in this aspect.
- b. The large cacumen and cacuminal lobes, very slender as they approach the cacumen but widening as they extend into the pileum. Compare Fig. 3. They form the lateral and dorsal limit of the cerebellum. Note their relations to the flocculus, peduncular sulcus, and the clival lobe.
- c. The thin submerged tuber. The cacumen and pyramis are separated so as to show the tuber more clearly. Compare Fig. 1, Pl. I. The crescentic tuberal lobes appear upon each side.
- d. The pyramis at the meson is almost flush with the adjacent mesal borders of the pyramidal lobes. It is demarcated from them by a deep cephalo-caudal sulcus.
- e. The pyramidal lobes comprise three foliated subdivisions. The two cephalic are slender and resemble the human lobes, *gracilis*, *anterior* and *posterior*, of some authors. But they are joined to the pyramis in this specimen. See pyramidal lobes, p. 124. The caudal portion resembles in general form the single lobe, which in man is joined to the pyramis.
- f. The uvula. The cephalic folium extends dorsad to about the same level as the caudal folium of the pyramis, but the caudal folia lie deep down in the vallecule. The uvular lobe (*tonsilla*) is small and concealed under (ventrad of) the caudal division of the pyramidal lobe.
- g. The nodulus should not be visible, but the two pyramidal lobes are drawn as if divaricated so as to show the uvula and tip of the nodulus.
- h. The tip of the epilexus protrudes ventrad of the pyramidal lobes.
- i. The flocculus, foliated and relatively larger than in man, is separated from the pileum by the floccular sulcus.
- j. The latero-cephalic part of the pileum, lateral borders of the clival and cacuminal lobes are visible cephalo-ventrad of the flocculus.
- k. The oblongata, pons, fifth, and eighth nerves are shown in outline.
- l. The olivæ, *ol.*

RELATION OF THE URETERS IN THE CAT TO THE GREAT VEINS; WITH VARIATIONS.

BY SIMON H. GAGE, B. SC., CORNELL UNIVERSITY.

DR. HUNTINGTON said: "Prof. Gage's most interesting specimens exhibit very beautifully not only the persistence of both post-cardinal veins, but their original embryonic position in reference to the ureter; that is to say, they represent individuals in which Hochstetter's "Durchwanderung" of the ureter through the post-cardinal vein, with an intermediate vascular island formation, has not occurred. They form an invaluable contribution to the development and morphology of the post-caval vein in the cat.

The persistence of both post-cardinal veins in the human ~~ct~~, so-called 'reduplication of the inferior vena cava,' condition which has been carefully described by human ~~omists~~ anatomists, although its occurrence is rare. Zander, in 1892,

published a comprehensive revision of the recorded cases. He found that in the last one hundred and fifty years only twenty-nine instances of the variation were published. We have encountered the persistent post-cardinal veins in adult human subjects in three instances during the past two years at Columbia.

"As far as I know, the dorsal position of the ureter, as exhibited in Prof. Gage's preparations, has not been encountered in the human subject. The ureter is ventral in two of our specimens. The third, received just before I left New York, has not been fully dissected as yet.

"Prof. Gage's specimens rank as arrest of development at the earliest stage."

NOTES ON THE APPENDIX.

BY BERT B. STROUD, D. SC., ITHACA, N. Y.

(Abstract.)

The surgical importance of the appendix demands that all deviations from the usual conditions should be known as widely as possible.

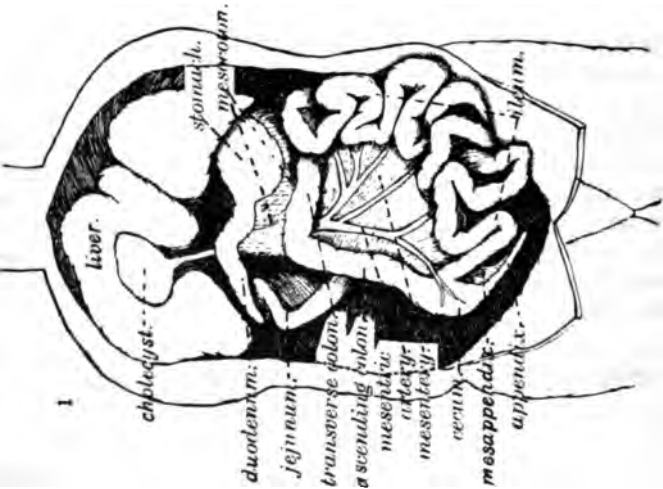
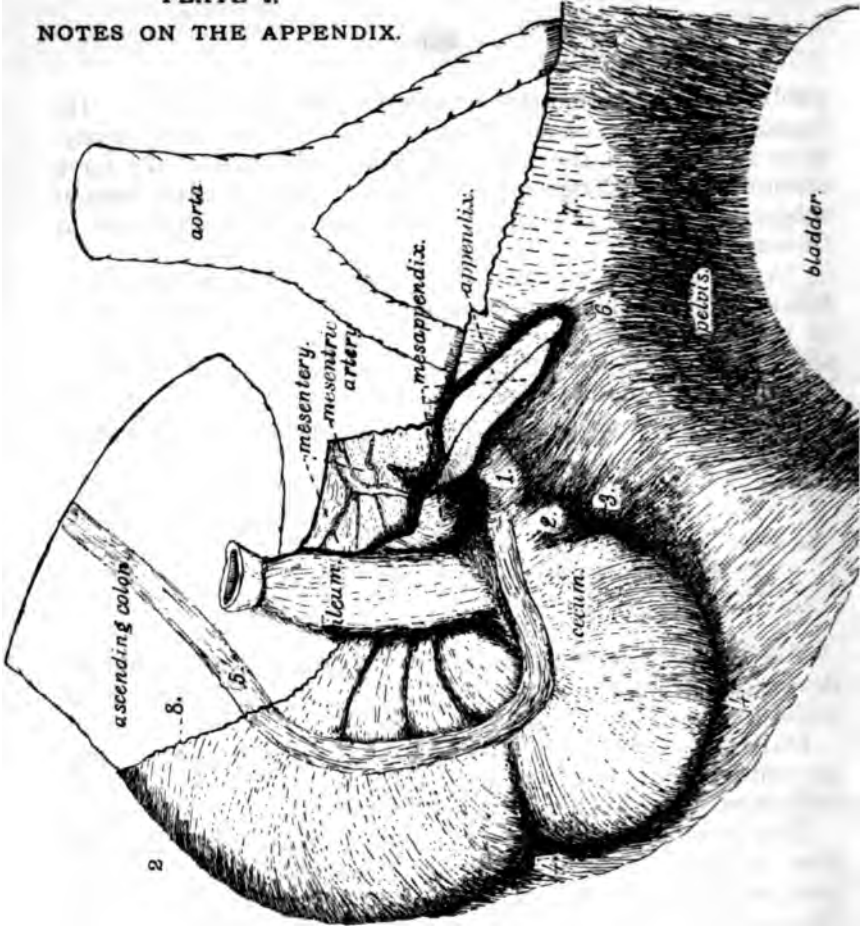
During past years a number of interesting specimens have accumulated in the museum of Cornell University. I hope to discuss them more fully at a future time.

The important observations, *embryologic and comparative, of Dr. G. S. Huntington have shown that we may expect to find any condition of the cecum and appendix, from the completely free, pendant appendix, to the post-cecal, erect form.

To this statement I would add that, judging from a seven to eight months' fetus and an old man of seventy-five, there may occur conditions varying from that of an entirely free and pendant ascending colon, cecum, and appendix, with no mesocolon or any attachment to the dorsal parietes. (See Fig. 1, Pl. I), and attached to the right border of the mesentery, to that of an adherent cecum and an appendix extending toward the meson and the brim of the pelvis and lying, for nearly half its length, wholly ectad (outside) of the peritoneum of the back. See Fig. 2, Pl. I.

* Studies in the development of the alimentary canal. Medical report of the Society of the Lying-in Hospital of the City of New York, 1893.

PLATE I.
NOTES ON THE APPENDIX.



B. B. Stroud, del.

The rarity of ectoperitoneal appendices is evidenced by the fact that among 577 recorded cases only 9 were found wholly or partly ectoperitoneal.

In the limited number of cadavers received at this laboratory, I have found one postcecal appendix and one partly ectoperitoneal, Case II. In two fetuses the appendix was partly outside the peritoneum.

Case I.—A 7 to 8 months hydrocephalus female fetus, American parents; No. 2,131. This specimen appears to be a normal and well developed child for this age. It is abnormal from the fact that the ascending colon, instead of occupying its usual fixed position in the right ilio-hepatic region, is perfectly free and entirely invested by serosa. It has no connection with the dorsal parietes but hangs as if suspended from the duodenum only, in the ventro-dextral region of the abdomen. It is attached to the right border of the mesentery of the small intestine and looks as though it formed part of a loop of the latter. But the presence of the cecum, appendix, and other structures proves its identity. See Fig. 1, Pl. I.

Case II.—An old man, Hollander, aged 75 years; No. 3,574. This case is peculiar in the fact that the appendix, cecum, ascending colon, and descending colon were invested by peritoneum less than is usually the case. All structures appeared to be normal. There was no evidence of pathologic adhesion. In form the cecum was the fourth type of Treves; it was closely adherent in the dorsal part of the right iliac fossa and could have undergone little movement other than that of peristalsis. The morphologic tip of the cecum and the proximal portion, about 25 mm., of the appendix were ectad of the dorsal peritoneum. See 1, 2, Fig. 2, Pl. I. The figure also shows the natural positions of the parts *in situ*.

The appendix was about 60 mm. long and doubled upon itself at the point where it pierced the peritoneum. The ectoperitoneal (proximal) portion pointed cephalo-mesad. The distal 35 mm. was free in the abdominal cavity and extended in a caudo-mesal direction. The tip nearly reached the brim of the pelvis near the right border of the promontory of the sacrum. The distal portion possessed a narrow mesappendix, packed with fat, which extended to the ileum as shown in Fig. 2.

The appendix itself is still further remarkable, because the distal or free portion was solid, the lumen having been

occluded. Its diameter was 4 mm. The proximal 25 mm. had a diameter of 6 mm., and contained a lumen communicating with that of the cecum.

The case is to be considered as illustrating the persistence of an embryonic condition similar to that of a child one year old, described by Dr. Huntington (1893, pp. 21, 22, Fig. XVIII).

Case III.—A 4 to 5 months male fetus, No. 3,661, shows a condition quite similar to case II, and the child reported by Dr. Huntington. The appendix was 36 mm. long, and coiled. Its proximal 6 mm. was ectoperitoneal. The distal 30 mm. was free and provided with a mesappendix.

DESCRIPTION OF FIGURES.

PLATE I.

Figure 1 is a 7 to 8 months' human fetus, American, No. 2,131, Museum of Cornell University. The specimen has been in the museum for some time. The body had been transected caudad of the kidneys, but there has been no interference with the parts concerned in this paper. I have added the outlines of the abdomen and hips so as to show the parts in their natural relations. It shows the parts, *in situ*.—

1. The large liver of the fetus, turned cephalad over the thorax, and the relations of the liver, stomach, large and small intestine.
2. The striking feature is that the ascending colon is entirely invested by peritoneum. It is attached only to the right border of the mesentery and is in no way joined to the back as in the usual condition. It appears in a ventral aspect as if it were suspended from the duodenum.
3. The fetal type of cecum and appendix.
4. The mesentery and mesenteric artery.
5. The coils of ileum at the left.

Figure 2 is the cecum and appendix of No. 3,546, a Hollander, aged 75. It shows:—

1. The relative position of the cecum and appendix, *in situ*, to the abdominal aorta, the right iliac fossa, the brim of the pelvis, and the bladder.
2. The cecum is shown as if tilted over to the right. What appears to be the right border is really the ventral side.
3. The ileum is tied and turned cephalad. A fragment of the mesentery is included for a landmark.
4. The mesappendix is moderately developed. It is attached along the caudal border of the ileum and only the distal 35 mm. of the appendix, the portion which alone is entirely invested by peritoneum.

The numbers indicate the following features, viz: 1. The proximal portion, 25 mm. of the appendix which lies entirely ectad of the peritoneum covering the dorsal parietes. 2. The morphologic tip of the cecum, also ectad of the peritoneum. 3. The point where the peritoneum begins to be reflected over the cecum. 4. The right iliac fossa. 5. The longitudinal muscle fibers of the intestine. 6. The brim of the pelvis. 7. The promontory of the rectum. The heavy line indicates a cut edge of peritoneum. 8. The heavy line indicates a cut edge of the serosa which invests the cecum and the proximal part of the ascending colon. The serosa is very loosely attached cephalad but is firmly adherent over the shaded area.

n.—On both figures the third *c* is omitted from *mesenteric*.

DR. HUNTINGTON said : " Dr. Stroud's specimens are very good examples of the influence which the serous and vascular ileo-cecal folds have on the final disposition of the adult appendix. In my experience the point which most constantly presents a distinct angular bend and is prone to fixation by serous adhesion is found at the confluence of the intermediate non-vascular fold with the dorsal vascular fold carrying the large dorsal ileo-cecal and appendicular artery. In the majority of instances the characteristic turn of the cecum to the left and the approximation of the root of the appendix to the ileo-colic junction depends on the early amalgamation of the non-vascular intermediate fold with the proximal portion of the dorsal vascular fold. The curves and bends of the appendix appear to depend principally upon the slow increase in length of the tube between two points which have been anchored or fixed at a comparatively early date. One of these points of fixation is usually afforded by the accession of the main post-cecal branch of the ileo-colic artery to the appendix ; the other is given by the point at which the area of fusion between the proximal part of the dorsal vascular fold and the intermediate fold terminates."

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OF THE
ELEVENTH ANNUAL SESSION

OF THE
Association
of
American Anatomists,

Held in New York City, December 28 to 30, 1898,

TO WHICH IS APPENDED A
LIST OF MEMBERS.

WASHINGTON, D. C.
BERESFORD, PRINTER, 618 F STREET.
1899.

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Maine,	5	Minnesota,	1
Connecticut,	5	Colorado,	1
Virginia,	5	California,	1
Ohio,	5		
Missouri,	5	England,	3
Canada,	4	Germany,	3
Illinois,	4	France,	2
Texas,	3	Ireland,	1
Louisiana,	2	Scotland,	1

Total: 122—112 active, 10 honorary.

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PROCEEDINGS OF THE ELEVENTH ANNUAL SESSION.

The eleventh session of the Association of American Anatomists was held at the College of Physicians and Surgeons, 437 West Fifty-ninth street, New York City (Medical Department of the Columbia University), in conjunction with the American Society of Naturalists and affiliated societies, December 28 to 30, 1898. At least forty-one members of the Association were present at some time during the meeting, namely, Blair, Blake, Brewer, Brockway, Carmalt, Collins, Coville, Craig, Crary, Dexter, Duncan, Dwight, Ferris, Fish, Frost, Gallaudet, Garrigues, Gerrish, Harrison, Haynes, Herrick, Holmes, Hopkins, Hrdlicka, Huntington, Kerr, Lamb, MacCarthy, Mall, Martin, Munro, Piersol, Rockwell, C. D. Smith, Shepherd, Stroud, Terry, Vosburgh, Weisse, Wilder, Woolsey. Twenty new members were elected.

WEDNESDAY, DECEMBER 28.

At 10.20 A. M., the Association was called to order by the President, Dr. Wilder, who delivered an address, "Some Misapprehensions as to the Simplified Nomenclature."

The report of the Executive Committee was read by the Secretary, Dr. Lamb, making the following recommendations, all of which were adopted by the Association: 1st. That contributors of papers be required to furnish to the Secretary abstracts of the same in advance of the printing of the program. 2d. That the propositions contained in the letter* of Professor

* TRINITY COLLEGE, DUBLIN, *October 11, 1898.*

DEAR DR. LAMB: I dare say you may have noticed that shortly after the death of Sir George Humphry of Cambridge, the editorial staff of the *Journal of Anatomy and Physiology* was to some extent reorganized. It now consists of Sir William Turner, Professor MacKendrick, Professor Macalister and myself. The editorial staff so composed is very desirous to encourage the publication in the *Journal* of contributions from American anatomists, and to extend the circulation of the *Journal* in the United States, and above all to make it representative of the entire English-speaking public.

Cunningham, of Dublin, in regard to the *Journal of Anatomy and Physiology* be accepted, and that Dr. Huntington * be se-

Ever since the Anatomical Association of Great Britain and Ireland was founded, the *Journal* has been its recognized organ, and in it are published abstracts of the proceedings of its meetings.

It has occurred to the editors that mutual benefit might be derived if the *Journal* were placed on the same footing with respect to the American Association of Anatomists. The two Associations would be thus brought more closely together, and anatomical work done in the two countries would be brought more prominently before both American and English workers.

Of course we could hardly expect your council to entertain such a proposal unless we were prepared to give some share in the working of the *Journal* to America. We would therefore propose, if the scheme which I outline is carried out, to co-opt an American editor, and upon this point we would value greatly any suggestions which you or your council might make regarding the anatomist whom you would consider most suited for the post.

In the purchase of the *Journal* we give no pecuniary advantage to members of the English association, but it has occurred to us that in the case of the American association we might contrive to make a slight reduction under certain conditions. In other words, if one hundred members of the American association would subscribe to the *Journal*, we would be prepared to reduce the subscription to four dollars per annum.

I think that the same rules which at present exist with reference to the English association might fairly well be applied to a new connection between the *Journal* and the American association, or at least they might serve as a basis for discussion. Briefly put, these rules would run as follows :

1. The Secretary of the Association to supply the acting editor, Professor Macalister, with an abstract of the proceedings of each meeting.
2. The right of accepting or refusing such of the Association papers as are offered for publication *in extenso* in the body of the *Journal* to rest with the American editor.
3. The Association to defray the cost of all figures which appear in the abstract of proceedings published in the *Journal*.
4. The Association to bear half the cost of all figures which appear in those papers which come from the Association and are published *in extenso* in the body of the *Journal*.

I shall ask the publisher to send to you those numbers of the *Journal* which have appeared under the new editorial staff.

I have a very vivid and pleasant recollection of the most successful meeting of the American association which I had the good fortune to attend in Washington. I sincerely hope something may be done, either by making our *Journal* a better medium, or by some other means, to bring American and English workers into closer touch and closer sympathy with each other.

Yours very sincerely,

D. J. CUNNINGHAM.

1.

ish editors.

lected as the American editor. 3d. That the Secretary and Treasurer of the Association be allowed his traveling expenses and ten dollars toward his hotel expenses at each meeting, this motion to take effect at the present meeting.

The Executive Committee recommended the election of the following candidates for membership: Barker, Brewer, Carmalt, Collins, Corson, Coville, Crary, Erdmann, Harrison, Heisler, Hrdlicka, MacCarthy, Mall, Martin, Rockwell, West; [see list of members.] On motion, the Secretary cast the ballot electing them.

The Secretary and Treasurer read his report, from which the following extracts are made:

The Proceedings of the last meeting were duly printed and distributed to members of the Association; about twenty copies were sent to libraries upon request and several to individuals who applied for them. I have on hand copies of all the Proceedings from the sixth to the tenth meetings inclusive; these are available to libraries or individuals desiring them. The editions of the first five meetings are now exhausted; the question of reprinting them might be referred to the Executive Committee with power.

We have lost only one member, Dr. Robert Reyburn, who resigned October 25th. There are 121 members—111 active, 10 honorary.

The financial year began December 28, 1897, with a balance in hand of \$62.68. Dues for 1897-98 have been paid to the amount of \$240.00; arrears of dues, \$36.00, making a total of available monies, \$338.68. Our expenses have been unusually large. A small assessment, \$3.00, for our share of the joint expenses at the Cornell meeting; a much larger assessment, coming every three years, \$94.08, our share of the expenses of the Congress of American Physicians and Surgeons, held in May, 1897; \$271.76 for printing, including the reports, the Proceedings, the circulars and official paper and envelopes. So far as I have received the opinions of the members, the printing has been satisfactory. For postage, \$50.41; the Proceedings, of course, and the circulars have been sent unsealed, in order to save some postage; occasionally I have sent stamps to correspondents to cover replies. The corre-

spondence of the office of Secretary and Treasurer has been large. For telegrams, \$2.66; for engraving the Allen frontispiece, \$2.50; for copying and typewriting, \$4.35. Total expenditures, \$428.76. It will be seen that the expenses exceed the receipts and balance on hand of 1897 by \$90.08, which I have advanced to the printer, to whom we still owe a balance of an even \$50. The total printing expense was therefore \$321.76. I have also received a bill of \$7.75 from Dr. Wilder for expenses connected with the nomenclature reports, making a total indebtedness of \$147.83.

The past year was the first in which the increased assessment, from two to three dollars per year, took effect. The dues in arrears amount to \$91.00 for 1897-8 and \$20.00 for 1896-7; total, \$111.00, of which I will probably collect \$75.00. The next meeting of the Congress of American Physicians and Surgeons will be in May, 1900, and our bill therefrom will be received the following year. It is possible, therefore, that by the next meeting, unless there should again be some unusual expense, the treasury may be out of debt. If we should follow our custom in regard to meeting with the Congress, we shall omit the December meeting of 1899, since it has been judged unwise to attempt consecutive December and May meetings.

I may say, however, in view of the facts that our expense for the meeting of the Congress is so nearly \$100.00 every third year, and that meeting with it prevents our meeting that year with the affiliated societies, the question has been raised as to whether this expense and its accompanying deprivation are offset by advantages of meeting with the Congress. This latter takes place always in Washington City and at a pleasant season of the year; at the last meeting there we had twenty-eight members present. On the other hand, we had twenty-three members present at the Philadelphia meeting of affiliated societies, and sixteen present at the Cornell meeting. I simply mention the matter. I think we should not make any precipitate change; but we might consult with the Physiologists, who are also members of the Congress.

The gentlemen who were elected honorary members at the last meeting have acknowledged the courtesy with the exception of Gegenbaur; at least I have not yet received his
tent.

The questions raised in the report of the Secretary as to reprinting the Proceedings of the first five meetings, and as to continuing the meetings with the Congress of American Physicians and Surgeons, were referred by the Association to the Executive Committee, with power to act.

Dr. Brockway, delegate to the Executive Committee of the Congress of American Physicians and Surgeons, stated that at present there was no report to make.

Dr. Lamb, from the Committee on Anatomical Peculiarities of the Negro, reported that no new suggestions had been received. The Committee was continued.

Dr. Huntington, from the Committee on the Table at Naples, stated that there was nothing new to report.

The President appointed Drs. Dwight and Gerrish a committee to audit the Treasurer's accounts. The reading of papers was then begun.

First. "The Teaching of Anatomy in our Medical Schools;" under the following divisions:

1. Preparatory education.
2. The value and place of General Biology and Comparative Anatomy.
3. Histology and Embryology in the medical course.
4. The relative value of didactic methods.
5. Practical Anatomy and how to teach it.
6. The order of topics.
7. The correlation of structure and function in teaching.
8. The use of charts and blackboards.
9. The qualifications requisite for a teacher of anatomy.
10. The desirability of terminologic consistency.

The subject was opened by Dr. Holmes with a paper on "The defects in our present methods;" Dr. Gerrish considered divisions 4, 6 and 8, and Dr. Huntington divisions 2, 3, 5 and 6.

The President appointed Drs. Dwight and Gerrish a committee to nominate a new member of the Executive Committee, in place of Dr. Bevan, whose time expired with this session.

The Association then adjourned, reassembling at 2.45 P. M. While awaiting an opportunity to use the lantern, Dr. Wilder discussed division 10 of "Teaching of Anatomy in our Medical Schools."

Dr. Dwight read a paper on "The origin of numerical variations of the vertebrae," illustrated by lantern slides. He also showed lantern slides of "The living model, showing the platysma in contraction."

Dr. Huntington then showed lantern slides and preparations illustrating the "Morphology and phylogeny of the vertebrate ileo-colic junction."

The first paper of Dr. Dwight was then discussed by Dr. Huntington.

"Examination of the caecum and appendix in 100 subjects;" illustrated by specimens and diagrams, by Dr. Martin. Discussed by Drs. Huntington, Shepherd, Lamb, Holmes, Dwight and Stroud.

Dr. Haynes gave "An explanation of a new method of cutting gross sections of the cadaver with demonstration of the technique." The Association then adjourned.

At 8 P. M. a meeting of members of the Society of Naturalists, of the affiliated societies and others, was held in the lecture room of the American Museum of Natural History, Seventy-seventh street and Ninth avenue. The President of the Museum, Morris K. Jesup, gave an address of welcome; after which Professor Osborn delivered a lecture on "Collections of fossil mammals and their care," illustrated by lantern slides.

At 9.30 P. M. there was a reception by Professor and Mrs. Osborn at their residence, 850 Madison avenue.

The Association re-
Wilder presided
ceeded

"

THURSDAY, DECEMBER 29.
d at about 9.30 A. M., Dr.
g of papers was at once pro-

1 nerve cells." Illustrated

by microscopic slides. By Dr. Stroud. Discussed by Dr. Ferris. "Preliminary account of the degenerations in the central nervous system of frogs deprived of the cerebrum." Illustrated by specimens. By Dr. Stroud. Discussed by Drs. Ferris and Wilder and, by invitation, by Dr. Max G. Schlapp of New York City.

The reading of papers was suspended to hear two reports from Dr. Dwight: first, from the Committee on auditing the accounts of the Treasurer, which were reported correct; and, second, from the Committee on nomination of a new member of the Executive Committee. Dr. Dwight reported the name of Dr. Holmes. Both reports were accepted. On motion, the Secretary was directed to cast the ballot for Dr. Holmes.

Dr. MacCarthy showed specimens of and made remarks upon a new dissection showing "The internal structure of the hippocampus." Discussed by Drs. Holmes, Wilder and Huntington.

"The roof and lateral recesses of the fourth ventricle considered morphologically and embryologically." Illustrated by lantern slides and specimens. By Dr. Blake. Discussed by Drs. Dexter, Stroud and Wilder.

The President announced the resignation of Dr. Dwight from membership of the Committee on Anatomical Nomenclature. The Association then adjourned until Friday morning.

At 3 P. M. the Societies met at Schermerhorn Hall, One hundred and sixteenth street west and Ninth avenue, where President Seth Low of the Columbia University gave an address of welcome, followed by short papers, ten minutes each, by a representative of each affiliated society, on the subject of "Advances in methods of teaching." This Association was represented by Dr. Huntington.

The annual dinner of the societies took place in the evening at the Hotel Savoy, Fifth avenue and Fifty-ninth street, at which the annual address of the President of the Society of Naturalists, Dr. H. P. Bowditch, was delivered.

FRIDAY, DECEMBER 30.

The Association reassembled at about 9.30 A. M., Dr. Wilder presiding.

The Secretary announced the receipt of a typewritten paper on the "Teaching of Anatomy," by Dr. Haynes. He also reported from the Executive Committee a recommendation that the following candidates for membership be elected: McMurrich, Russell, Vosburgh; [see list of members.] On motion, the Secretary cast the ballot electing them.

The following recommendation of the Executive Committee was adopted: "That the maximum limit of papers hereafter read to the Association, should be thirty minutes. This rule to take effect at the next session."

On motion of Dr. Shepherd, it was decided that hereafter brief abstracts of papers to be read should be printed with the program.

The following papers were read by title:

"Further tabulation and interpretation of the paroccipital fissure (occipital division of the intraparietal complex)." By Dr. Wilder.

"Cerebral fissures and visceral anatomy of the Eskimo from Smith's Sound." By Dr. Huntington.

Dr. Wilder corrected some current misapprehensions as to the object of his collection of brains.

Dr. Huntington made some remarks on "Visceral and vascular variations in human anatomy." Illustrated by preparations and drawings. "Further notes on the relation of the ureters and great veins." By Prof. Gage. Abstract read by Dr. Hopkins. Both papers were then discussed together by Drs. Huntington, Shepherd, Blair, Wilder and Terry.

"Morphology of the digestive tract of the cat." Illustrated by drawings. By Dr. Dexter. Discussed by Drs. Wilder, Huntington and Blake.

"Contribution to the anatomy of the reptilian vascular system." By Dr. Huntington. Read by title.

"The sternalis muscle." Illustrated by specimens and casts. By Dr. Huntington. Discussed by Drs. Shepherd, Dwight and Wilder.

"An X-ray study of the normal movements of the carpal bones and wrist." By Dr. Corson. An abstract of the paper was read by Dr. Hopkins.

"Preliminary report on the surgical relations of the duodenal orifice of the common bile-duct." Illustrated by specimens. By Dr. Brewer. The Association then adjourned.

Reassembled at 2.30 P. M.

The Executive Committee reported favorably on the application of Dr. Garrigues for membership. On motion, the Secretary cast the ballot electing her. [See list of members.]

Dr. Shepherd was called to the chair and the report of the majority (Drs. Gerrish, Huntington and Wilder) of the Committee on Anatomical Nomenclature was read by the Secretary of the Committee, Dr. Wilder. Dr. Dwight moved that the report be accepted and the committee discharged. Dr. Spitzka moved as an amendment that the report be accepted and adopted, with the words "and the committee discharged" omitted. The motion and amendment were discussed by Drs. Spitzka, Gerrish, Wilder and Dwight. The amendment was carried by a vote of eleven to two. The original motion as amended was then discussed by Drs. Lamb, Spitzka and Wilder, and adopted without dissent. [Drs. Dwight and Munro, who had voted against the amendment, left the meeting before the vote on the amended motion was taken.]

The reading and discussion of papers was then resumed.

Dr. Brewer's paper on the bile-duct was discussed by Drs. Shepherd and Huntington.

"The normal human tibia." Illustrated by specimens. By Dr. Hrdlicka. Discussed by Drs. Huntington, Shepherd, Lamb and Herrick.

"The genito-urinary system of the American pit-viper." By Dr. Huntington. Read by title.

The resignation of Dr. Dwight as a member of the Com-

mittee on Anatomical Nomenclature was then accepted, and the President was authorized to fill the vacancy.*

The Secretary stated that our membership was now 141—131 active and 10 honorary. He also moved a vote of thanks to the President of the University, and the College of Physicians and Surgeons, and especially to Dr. Huntington and his associates for the facilities afforded and courtesies extended. The motion was unanimously adopted.

The Association then adjourned.

NOTE 1.—Abstracts of the Proceedings have been published in *Science*, the *Philadelphia Medical Journal*, *Journal of Anatomy* and *Physiology*, etc.

NOTE 2.—Since the last meeting, Drs. Balloch and Deaver have resigned, Dr. Marsh died, and notice has been received of the death of Dr. Lindsay.

* Dr. E. C. Spitzka has since been selected.

CONSTITUTION.

SECTION 1. The name of the society shall be the "ASSOCIATION OF AMERICAN ANATOMISTS."

SEC. 2. The Association shall have for its object the advancement of the anatomical sciences.

SEC. 3. The officers of the Association shall consist of a President, two Vice Presidents, and a Secretary, who shall also act as Treasurer.

SEC. 4. The officers shall be elected by ballot every two years.

SEC. 5. The management of the affairs of the Association shall be delegated to an Executive Committee, consisting of its President, Secretary and three other members.

SEC. 6. One member of the Executive Committee shall be elected annually.

SEC. 7. The Association shall meet annually, the time and place to be determined by the Executive Committee.

SEC. 8. Candidates shall be proposed in writing to the Executive Committee by a member. Each proposal shall be made at or before the first session of any regular meeting of the Association. The proposal shall state the official position or occupation of the candidate and the character of his investigations. The election shall take place by ballot in open meeting, a two-thirds vote being necessary. Honorary members may be elected from those, not Americans, who have distinguished themselves in anatomical research.

SEC. 9. The annual dues shall be three dollars. A member in arrears for dues for two years shall be dropped by the Secretary at the next succeeding meeting of the Association, but may be restored on payment of arrears, at the discretion of the Executive Committee.

SEC. 10. The rulings of the Chairman shall be in accordance with "Robert's Rules of Order."

SEC. 11. Five members shall constitute a quorum for the transaction of business.

OFFICERS FOR THE YEAR 1898-99.

DR. B. G. WILDER, of Ithaca, N. Y., - - - - President.
 DR. GEO. A. PIERSOL, of Philadelphia, Pa., - First Vice President.
 DR. WM. KEILLER, of Galveston, Tex., - - Second Vice President.
 DR. D. S. LAMB, of Washington, D. C., - Secretary and Treasurer.

DELEGATE TO EXECUTIVE COMMITTEE OF CONGRESS OF AMERICAN
 PHYSICIANS AND SURGEONS 1897-1900.

DR. F. J. BROCKWAY, of New York City.

ALTERNATE.

DR. R. W. SHUFELDT, of Washington, D. C.

EXECUTIVE COMMITTEE.

DR. F. H. GERRISH, of Portland, Me.
 DR. F. J. SHEPHERD, of Montreal, Can.
 DR. E. W. HOLMES, of Philadelphia, Pa.
and the
 PRESIDENT and SECRETARY, *ex officio*.

COMMITTEE ON ANATOMICAL NOMENCLATURE.

DR. FRANK BAKER, of Washington, D. C., *Chairman*.
 DR. F. H. GERRISH, of Portland, Me.
 DR. GEO. S. HUNTINGTON, of New York City.
 DR. E. C. SPITZKA, of New York City.
 DR. BURT G. WILDER, of Ithaca, N. Y., *Secretary*.

COMMITTEE ON CIRCULAR IN REGARD TO ANATOMICAL PECULIARITIES
 OF THE NEGRO.

DR. D. S. LAMB, of Washington, D. C.
 DR. FRANK BAKER, of Washington, D. C.
 DR. D. K. SHUTE, of Washington, D. C.

MEMBERS OF SMITHSONIAN COMMITTEE ON THE TABLE AT NAPLES.

DR. GEO. S. HUNTINGTON, of New York City.
 DR. THEODORE GILL, of Washington, D. C.

SOME MISAPPREHENSIONS AS TO THE SIMPLIFIED NOMENCLATURE OF ANATOMY.*

Let it not be interpreted as indifference to the honor of election to an office held by the lamented Joseph Leidy and Harrison Allen if I express even more profound gratification in another action of this Association at its meeting a year ago, viz., the adoption, without dissent, by such of the members as were sufficiently interested to attend, of the 'Report of the Majority † of the Committee on Anatomical Nomenclature' (*Proceedings*, pp. 27-55).

It was then my hope and expectation to lay aside that matter for a year in favor of others already too long deferred. Least of all did I contemplate making it the subject of the present address. The change of plan is due to considerations which may be summarized thus: As investigators our main purpose is to comprehend; as writers and teachers our first duty is to be clear; when, therefore, we have reason to believe that in the minds of our fellows there is obscurity upon a subject of common interest to which we have given particular attention we should avail ourselves of any special opportunity of elucidation, the imperativeness of this obligation being directly proportionate to the personal, professional and official importance of those who seem to need enlightenment.

When, therefore, it is announced that at this meeting the Association will be called upon, in respect to nomenclature, to 'reconsider its acts from the beginning' ('Minority Report,' p. 57); when those who make this announcement are among the original members of the Association and its only surviving past Presidents; when, upon both sides of the water, there have been published reports, articles, reviews and paragraphs in books ‡ containing, however unintentionally, state-

* Address of the President at the opening of the eleventh annual session of the Association of American Anatomists, December 28, 1898.

† F. H. Gerrish, Geo. S. Huntington and myself.

‡ 1. Verhandlungen der Anatomischen Gesellschaft auf der neunten Versammlung, in Basel, April, 1895. *Anat. Anzeiger*; Ergänzungsheft zum X. Band; [p. 162].

2. His, W.—Die anatomische Nomenclatur. Nomina anatomica. Verzeichniss der von der Anatomischen Gesellschaft auf ihrer IX. Versammlung in Basel angenommenen Namen. Eingeleitet und im Einverständniss mit dem

ments so inadequate, exaggerated, or even inaccurate, as to mislead those not themselves acquainted with the facts; and when, finally, it is probable that the facts are more familiar to me than to any other single individual, it becomes not merely my privilege but my duty to share my information with the members of this Association and with others interested who may have lacked the time or opportunity to gain it hitherto.

So numerous are the misapprehensions as to the nature of the simplified nomenclature and the purposes of its advocates that it is impossible to consider them all fully upon the present occasion; some, indeed, will be merely stated in the hope that such statements may carry their own correction. Certain points were presented two years ago.* If, in a few instances, I repeat what I have previously published, precedent for so doing may be found in these words of Huxley:

Redactionsausschuss erläutert. *Archiv für Anatomie und Physiologie*. Anat. Abth., Supplement Band, 1895. O., pp. 180; 27 figs., 2 plates, 1895; [pp. 6-7].

3. Herr Burt Wilder und die Anatomische Nomenclatur. *Anat. Anzeiger*, XII., 446-448, Oct. 30, 1896.

4. Kölliker, A. von.—Handbuch der Gewebelehre des Menschen. Sechste Auflage. Zweiter Band. Nervensystem des Menschen und der Thiere. O., pp. 874, 845 figs. Leipzig, 1896; [p. 814].

5. Dwight, Thomas.—Wilder's System der Nomenklatur. *Ergebnisse der Anatomie und Entwicklungsgeschichte*, 1897, pp. 471-479.

6. Baker, Frank.—Review of the foregoing. *Science*, VII., 715-716, May 20, 1898.

7. Baker, F., and Dwight, T.—Report of the Minority of the Committee on Anatomical Nomenclature. *Proceedings of the tenth annual session of the Association of American Anatomists*, December 28, 1897, pp. 55-57.

8. 'Reviews of Mills,' 'The Nervous System and its Diseases,' in various medical journals; 1898.

* Neural Terms, International and National, *Journal of Comparative Neurology*, VI., December, 1896, pp. 216-352, including seven tables. Parts VII.-IX. have also been reprinted under the title 'Table of Neural Terms, with Comments and Bibliography,' including also 'Suggestions to American Anatomists.' Copies of the entire paper and also of the 'Tables,' etc., were sent to all members of all committees on nomenclature, here and abroad, and to many other anatomists and neurologists. To them were also sent copies of the 'Table,' etc., and the latter was still more widely distributed to others more or less directly interested in the subject. My reprints of the entire paper are exhausted; of the 'Table,' etc., some copies remain that will be sent upon application. The larger part of the paper is contained in the lecture 'Some Neural Terms,' in 'Biological Lectures' [at the Marine Biological Laboratory] for 1896-7. The 'Errors and Omissions' detected in my Lists of Neural Terms have been corrected in the *Journal of Comparative Neurology*, VIII., pp. li-lii, July, 1898; a leaflet reprint has been inserted in copies of 'Neural Terms' and of 'Table of Neural Terms' distributed since March 30, 1898, and will be sent upon request to those who received copies prior to that date.

"When objections are ignored without being refuted or even discussed, I suppose the best way is to emphasize them afresh." *Zool. Soc. Proceedings*, 1883, p. 139.

*Misapprehension I.** That the 'Majority Report' embodies the positive convictions of one member and the merely passive acquiescence of the other two.—Such an impression not only might be, but actually has been, produced by the 'Minority Report.' Nothing could be less accurate or just.

The members of this Association need only be reminded that the two other signers of the 'Majority Report' are among the more active of our associates; that they are writers, and are, or have been, practitioners; and that they are teachers of anatomy in long-established medical schools.

But even more significant in this connection is something best known to those who know them best. These men, in a notable degree, combine intellectual independence with liberality; in other words, they are conspicuously free from two qualities shared by the human species with certain other mammals, *viz.*, uncritical imitation, on the one hand, and, on the other, hostility toward what appears to be new merely because they are personally unfamiliar with it.

With regard to the matter in question, as was expressly stated in the 'Majority Report' (p. 31, § 2, 5), "with few exceptions the terms recommended had been adopted by each member individually, and prior to the conference at which joint action was taken."†

Notwithstanding the nature of their convictions, if the larger number of those in attendance at the present session decide to materially modify or even reverse the action of a year ago, the majority of your committee will offer no factious opposition.‡ They will, however, feel none the less proud of their work and confident of its eventual readoption. Their sentiments may be compared, although somewhat remotely, with those of the surgeon who had devised a new flap for amputation of the thigh. Upon the first trial, just as the

* The succeeding misapprehensions will be designated simply by Roman numerals.

† For the complete appreciation of the situation it should perhaps be added that the two other signers of the 'Majority Report' were appointed on the Committee respectively by the two signers of the 'Minority Report,' while serving as presidents.

‡ At the closing session (Dec. 30, 1898) of the eleventh meeting the second Report submitted by the majority of the Committee was adopted by the Association.

operation was triumphantly completed, an overdose of chloroform killed the patient. "Too bad," said the surgeon, "but at any rate he'll go to heaven with the best flap that ever was made."

II. *That any action of the Association with respect to the use of terms has binding force.*—From certain expressions it might be inferred that the adoption of a report on nomenclature was tantamount to the enactment of rules or by-laws, conformity to which constitutes an indispensable condition to the maintenance of membership. On the contrary, the recommendation and acceptance of certain terms merely entitles them to particularly respectful consideration and throws upon those who prefer others the burden of proof that those others are superior. As an illustration of the impunity with which somewhat stringent injunctions may be disregarded may be mentioned the following: In the *Anatomischer Anzeiger* (March 3, 1897, pp. 323-329), in a paper by Dr. Edward Flatau, 'Beitrag zur technischen Bearbeitung des Centralnervensystems,' prepared in the Anatomic Institute at Berlin, the Director of which is Professor Waldeyer, a member of the B. N. A. Commission and of the Gesellschaft that recommended *Dura mater encephali* and *Pia mater encephali*, the mononyms *dura* and *pia* occur two and four times respectively, and the authorized polyonyms are conspicuous by their absence.

III. *That action of the majority of a committee should be delayed indefinitely by the absence or unpreparedness of the minority after due notice is given.*

IV. *That the condemnatory phrases of the 'Minority Report' can, in any considerable degree, be justly applied to the actual contents of the 'Majority Report.'*

V. *That the non-adoption of a term, whether from the German list or my own, constitutes a declaration against it.*—It signifies merely a suspension of judgment and a postponement of action.

VI. *That differences of usage or recommendation between American and foreign anatomists or organizations should be removed in all cases by the abandonment of our position.*

VII. *That the efforts of this Association for the simplification of nomenclature should be paralyzed by the disapprobation of foreign anatomists whose unfamiliarity with what is done in America is to be explained only by an indifference thereto.*—

Among numerous instances of this indifference I select one with which my own connection is so remote as to eliminate the element of personal irritation. At the meeting of this Association in December, 1895, there was presented an elaborate 'Report on the Collection and Preservation of Anatomical Material.' It was printed in our *Proceedings* (15-38) and in *Science*, III., January 17, 1896; was mentioned in several journals and listed in the 'Literatur' in the *Anatomischer Anzeiger*. Yet in September, 1898, practically an entire number of that periodical, twenty-five pages, was occupied by an article on that subject purporting to tabulate and discuss the methods employed in all parts of the world. The whole United States is credited with an article by Mall (*Anzeiger*, 1896, 769-775) and (in a footnote) a 'Note' by Keiller in the *Texas Medical Journal*, 1891-2, VII., p. 425.

VIII. *That terms consisting of a single word each constitute even the majority of the names preferred by me or adopted by this Association a year ago.*—Whatever their abstract preferences, the members of the Committee realize the impossibility of framing such a nomenclature. Two years ago ('Neural Terms,' §153 *et seq.*), I showed by statistics the baselessness of the misapprehension and characterized it as a 'terminologic phantasm erected by the Germans between themselves and the American Committees.'

More recently, however, the same notion has reappeared in several reviews of a text-book of nervous diseases, commonly with approval, expressed or implied, of the supposed condition. The impression was probably gained from the fact that the author of the book, like myself, prefers single-word names for as many as possible of the parts most frequently mentioned. Nevertheless, the misapprehension on this point ought to be corrected. The facts are:

First, out of about 540 neural terms in the B. N. A. at least 40, about one-fourteenth, are mononyms.

Secondly, in the 'Majority Report,' in Tables C and D, are enumerated 274 terms differing more or less from those adopted by the Gesellschaft; the mononyms number only 103.

IX. *That eminence as an anatomist necessarily implies either the capacity or the disposition to deal wisely with questions of nomenclature.*—Upon this point I quote from 'Concluding Remarks' in 'Neural Terms,' p. 329:

"Caution in Publishing New Terms.—It is true that words needlessly introduced into anatomy have no such embarrassing permanency as is conventionally assigned to synonyms in systematic zoölogy. Nevertheless, for a time at least, they encumber current publications and dictionaries. Hence, however necessary and legitimate they may seem to the framer, neither a new term, nor an old one in a new sense, should be actually published without prolonged consideration, and consultation with at least four individuals representing as many categories of possible critics: (a) an investigator of the same general subject; (b) an experienced teacher; (c) an earnest student; (d) a philologic expert whose admiration for the past has not blinded him to the needs of the present and the future.

"Method of Introduction of New Terms.—As urgently recommended by the A. A. A. S. Committee on Biological Nomenclature (§84), whenever a technical word is used for the first time, the author should give in a special note: (a) the Latin form; (b) the etymology; (c) the proper adopted form or paronym for his own language, with the adjective, etc., when applicable; (d) as concise and precise a definition as possible."

X. *That among the terms included in the 'Majority Report' any considerable number have been specifically condemned by the Anatomische Gesellschaft or its authorized representatives.*

XI. *That the grounds of such objections as have been offered are really sound and sufficient.*

XII. *That the condemnation of a term by an anatomic authority disproves either its intrinsic fitness or its promise of vitality.*—On this point there need be adduced only the cases of *radius* and *ulna*, which Robert Hunter denounced as 'ridiculous.'

XIII. *That the anatomy of the future is to be based upon the structure and erect attitude of the human body.*—The anatomists of the future will be zoötomists first and anthropotomists afterward.

XIV. *That every anatomic term should be an absolute idionym, i. e., perfectly explicit in itself.*—Since this requirement is implied in the objections to *aula*, etc., by Kölliker, and to *medipeduculus* by His,* there may be properly adduced from the B. N. A. the following terms, whose explicitness is conditioned upon either the context or the actual addition of the words here set in brackets: *clivus* [*occipitalis*], and [*sphenoidalis*]; *processus coronoidæus* [*ulnae*] and [*mandibulae*]; *processus styloideus* [*radii*], [*ulnae*] and [*ossis temporalis*]. Unless, indeed, it be granted that a certain degree of explicitness is afforded by the context, every one of the thousands of names of the parts of the human body should be increased by the phrase *corporis humani*.

* As stated and briefly discussed in 'Neural Terms,' pp. 282-289.

XV. *That the occasional employment, by a member of an Association, or even by a member of its Committee on Nomenclature, of terms other than those adopted by them is, in itself, evidence of deliberate intention.*—For example, after using *conarium* for fifteen years in place of 'pineal body,' etc., now that the arguments of Spitzka and H. F. Osborn have converted me to *epiphysis*, *conarium* occasionally gets itself spoken. Indeed, it is easy for me to understand that an unintended but familiar word may be written, re-written, and even overlooked in the proof. The frequency of such lapses could be shown, if necessary, by letters from numerous correspondents in reply to the query, free from all critical or proselytic tenor, as to whether a given term was used intentionally or by inadvertence.

XVI. *That there is 'imminent danger of the formation of a peculiar anatomic vocabulary in America such as seriously to impede scientific intercourse with other countries.'*—The unsubstantiality of the grounds of this misapprehension may be recognized in the impartial discussion by the brothers Herrick a year ago.* They conclude that there is no reason for serious alarm on this score.

XVII. *That the fundamental principles and characteristic features of the simplified nomenclature can be attributed to any individual in such degree as to warrant calling it by his name.*—In correcting this misapprehension no false modesty shall lead me to belittle what I have done. On the contrary, to the 'Summary of my terminologic progress,' already published in 'Neural Terms,' etc. (pp. 227-237), there shall be added here two items overlooked when that was printed:

1. That the defects of encephalic terminology had been recognized by me as early as 1873 may be seen from the following paragraph in a popular lecture on 'The brain and the present scientific aspects of phrenology,' delivered January 21st, before the 'American Institute,' and reported in the *New York Tribune* of January 22d and in the '*Tribune Extra*,' No. 3:

"As if these natural hindrances were not enough, the old anatomists fenced in the parts of the brain with the most fanciful and prodigious titles. *Cerebrum* is well enough; the *cerebellum*, being only one-eighth as large, has a longer name, while *medulla oblongata*, *hippocampus minor*, *tubercula quad-*

* 'Inquiries regarding tendencies current in neurological literature;' *Jour. Comp. Neurology*, VII., 162-168, December, 1897.

rigemina, processus e cerebello ad testes, and iter e tertio ad ventriculum quartum represent such insignificant parts of the brain as to suggest a suspicion that the nomenclature was established upon no other principle than that of an inverse ratio between the size of an organ and the length of its title. At any rate, these fearful names are stumbling-blocks to the student and an almost perfect hindrance to popular knowledge of the brain; no doubt this pleases the ghosts of the old anatomical fathers, and is equally agreeable to many of the present day, both in and out of the profession, with whom Latin is a synonym for learning, and ponderosity of words for profundity of wisdom."

2. My actual efforts toward the simplification of the nomenclature of the brain commenced in 1880, in the preparation of a paper read before the American Association for the Advancement of Science on the 28th of August. The paper was never written out in full, and apparently no abstract was furnished for publication in the *Proceedings*. Somewhat inadequate and erroneous reports were printed in the *Boston Daily Advertiser* of August 30th, and in the *New York Medical Record* of September 18th. But here is a duplicate of the abstract furnished in advance to the Secretary of the Association, and I venture to read it as a contribution to the history of the subject now before us:

"PARTIAL REVISION OF THE NOMENCLATURE OF THE BRAIN.

"A. *Introductory*.—The progress of anatomy is impeded by the defects of nomenclature. These defects have been admitted by several anatomists, and a few have endeavored to remedy them. As stated by Pye-Smith, 'the nomenclature of the brain stands more in need of revision than that of any other part.'

"B. *Nature of the Defects*.—(1) General. In common with that of the rest of the body, the nomenclature of the brain lacks precision as to the position and direction of parts. (2) In particular the number of synonyms is very large. Most writers employ some names which are vernacular or merely descriptive. Most technical names are compound; many of the single ones are inconveniently long, and some of them are indecent.

"C. *Special Obstacles to a Reform*.—(1) The difficulty of ascertaining the priority of terms. (2) The tendency of each nation to adopt purely vernacular terms which have been proposed or incidentally employed by eminent anatomists of that nation.

"D. *Principles Forming the Basis of this Revision*.—(1) Technical terms are the tools of thought, and the best workman uses the best tools. (2) Terms of classical origin are to be preferred. (3) Priority of employment is to be regarded, but should not overbear all other considerations. (4) Of two terms equally acceptable in other respects, to select the shorter. (5) Preference for names of general application over those which have an exclusive application to man or the other primates. (6) To convert some compound terms into simple ones, either by dropping unessential words or by the substitution of prefix-
to (7) For terms of position, to discard all which refer to the natural attitude of man, and to adopt those which refer to the axis of the vertebrate body. (8) For terms of relation, to employ those used for position with the termi-

"E. *The Paper Will Indicate*: (1) The terms proposed and their abbreviations. (2) The principal synonyms. (3) The originators of the terms and synonyms and the dates of their first employment, so far as ascertained. (4) The terms which should be wholly discarded. (5) The new terms for new parts, the new terms for parts already known, the new forms of old terms. (6) The subordination of parts to wholes by differences in the kinds of type."

There were present Harrison Allen, Simon H. Gage, Charles S. Minot and probably other members of this Association; the survivors will recall that on cloth sheets were written in parallel columns certain names in common use, together with those which were proposed to replace them. Amongst these were *pons* for 'pons Varolii,' *insula* for 'insula Reillii,' *thalamus* for 'thalamus opticus,' *callosum* and *striatum* for 'corpus callosum' and 'corpus striatum,' *prae Commissura* for 'commissura anterior,' *myelon* for 'medulla spinalis,' and *cornu dorsale* for 'cornu posterius.' This paper constituted the proton (the *primordium*, or 'Anlage,' if you prefer) of my own subsequent contributions, and likewise, so far as I knew at the time, of the simplified nomenclature in America.

Proud as I am of these early propositions, and glad as I should be if they and their subsequent elaborations had been at once unprecedented and sufficient, nevertheless truth, justice, and the peculiar conditions now confronting us alike impel me upon this occasion to insist even more distinctly than hitherto upon the extent to which the ideas and even the specific terms had been anticipated by four other anatomists in this country and in England.

Already in the spring of 1880, although quite unknown to me, there had been published a paper by E. C. Spitzka, 'The Central Tubular Gray' (*Journal of Nervous and Mental Disease*, April, 1880), containing (p. 75, note) the following pregnant paragraph:

"It would add much to the clearness of our terminology, in my opinion, if the adjectives anterior and posterior were to be discarded. Physiologists and anatomists are so often forced to deal with the nerve axes of lower animals, in whom what is with man the anterior root becomes inferior, and what is in the former posterior becomes superior, that they have either been confused themselves or have written confusedly, or finally have, to avoid all misunderstanding, utilized the terms applicable to man alone also for quadrupeds. The nervous axis, however, occupies one definite position, which should determine the topographical designations. What in man is the anterior, and in quadrupeds the inferior, root or cornu is always *ventral*; while what in the former is posterior, and the latter superior, is always *dorsal*. The present treatise is not the proper place for renovating nomenclature, but I have thought it well to call attention to the matter in passing and in anticipation of a work on comparative neural morphology which I have in preparation."

The concluding words are italicized by me in order that there may be the more fully appreciated the generosity, indeed self-abnegation, exhibited in Dr. Spitzka's commentary * upon my longer paper † of the following year :

"It is with mingled pleasure and profit that I have read the very suggestive paper on cerebral nomenclature contributed to your last issues by Professor Wilder. Some of the suggestions which he has made have been latent in my own mind for years, but I have lacked the courage [time?] to bring them before my colleagues. Now that he has broken ground, those who prefer a rational nomenclature to one which, like the present reigning one, is based upon erroneous principles, or rather on no principles at all, will be rejoiced at the precedent thus set for innovations. * * * He who has himself been compelled to labor under the curse of the old system, the *beneath*, *below*, *under*, *in front of*, *inside*, *external*, *between*, etc., will look upon the simple *ventral*, *dorsal*, *lateral*, *mesal*, *cephalic*, *proximal*, *caudal*, *distal*, etc., as so many boons. I have no hesitation in saying that the labor of the anatomical student will be diminished fully one-half when this nomenclature shall have been definitely adopted. * * * In proceeding to comment on some of the terms proposed by Professor Wilder, I wish it to be distinctly understood that I do so merely tentatively and to promote discussion ; in so doing I feel certain that I am carrying out that writer's wishes. It is but just to state that the majority of the terms cannot be discussed ; they are perfection and simplicity combined."

Had Dr. Spitzka completed his proposed work he would doubtless have called attention to our three British predecessors, John Barclay, Richard Owen, and P. H. Pye-Smith.

The first, as long ago as 1803, in a 'New Anatomical Nomenclature,' proposed the unambiguous descriptive terms, *dorsal*, *lateral*, *proximal*, with their adverbial forms, *dorsad*, *laterad*, and *proximad*, and thus laid the foundation for an intrinsic toponymy.

In 1846 Owen published ('Report on the Vertebrate Skeleton,' p. 171) what I have elsewhere ('Neural Terms,' § 51) called the 'immortal paragraph,' wherein the various phrases for the spinal portion of the central nervous system were replaced by the single word, *myelon*. Twenty years later he uttered ('Anatomy of Vertebrates,' I., 294) a declaration which some of us are disposed to regard as an inspired prophecy :

"Whoever will carry out the application of neat substantive names to the homologous parts of the encephalon will perform a good work in true anatomy." In the third volume of the same work (1868, p. 136) is a list of the cerebral fissures designated, in most cases, by adjectives of a single word each, *e. g.* *subfrontal*.

* Letter on nomenclature, *Science*, April 9, 1881. Also in *Jour. Nerv. and Mental Dis.*, July, 1881, 661-662.

† A partial revision of anatomical nomenclature, with especial reference to that of the brain, *Science*, II., 1881, pp. 122-126, 133-138, March. Also *Jour. Nerv. and Mental Dis.*, July 1881, 652-661.

The paper of Pye-Smith (fortunately still spared to us) was entitled 'Suggestions on Some Points of Anatomical Nomenclature,' and appeared in 1877 (*Journal of Anatomy and Physiology*, XII., 154-175, October, 1877). After enunciating certain sound general principles, he declared that 'the nomenclature of the brain stands more in need of revision than that of any other part,' and made several specific suggestions some of which have been adopted by the three American Associations and the Anatomische Gesellschaft:

"The term optic thalamus is a misleading and cumbrous abbreviation of the proper name *thalamus nervorum optico-rum*, and the name *thalamus*, without qualification, is at once distinctive, convenient, and free from a false suggestion as to the function of the part. * * * Of all the synonyms of the *Hippocampus minor* (*Ergot of Morand*, *eminentia unciformis*, *colliculus*, *unguis*, *calcar avis*) the last is the most distinctive, and brings it at once into relation with the calcarine fissure. The *Hippocampus major* may then drop the adjective, as well as its synonym of *cornu ammonis*. The pineal and pituitary bodies are more conveniently called *conarium* and *hypophysis*. * * * The word *Pons* (Varolii) might well be restricted to the great transverse commissure of the cerebellum. * * * *Insula* is a far more distinctive name than any proposed to replace it." Pye-Smith also prefers *vagus* to 'pneumogastrius.' (p. 162.)

Those who have done me the honor to read any one of my longer papers on this subject will recall my repeated acknowledgments of indebtedness to these three English anatomists. Not to mention earlier publications, in 1889, in the article 'Anatomical Terminology' ('Reference Handbook of the Medical Sciences,' VIII., 520-522), Professor Gage and I collected from all sources accessible to us 'Aphorisms respecting Nomenclature;' the most prolific sources were the three just named. At the third meeting of this Association, in Boston, December, 1890, I read a paper the title of which was 'Owen's Nomenclature of the Brain,' and which included this paragraph:

"In none of the above-designated publications or in those of other anatomists does it now seem to the writer that there has been adequate recognition of the terminological precepts and examples that occur in the works of Professor Richard Owen, and the writer takes this opportunity to express his constantly increasing sense of obligation in this regard; had space permitted he would gladly have increased the number and length of the selections from Professor Owen's writings which are embraced among the 'Aphorisms respecting Nomenclature' on pp. 520-522 of the article 'Anatomical Terminology.'"

In this connection may appropriately be mentioned two later but highly significant British contributions toward a simplified and international system of nomenclature.

1. The Latin names for the encephalic segments.—In the seventh edition of Quain's 'Anatomy,' edited by William Sharpey, Allen Thompson and John Cleland, in Vol. II., dated 1867, the five 'fundamental parts' (corresponding to what I have called "definitive" segments) are named *prosencephalon*, *diencephalon*, *mesencephalon*, *epencephalon*, and *metencephalon*; and in a foot-note these terms are declared to be "adopted as applicable to the principal secondary divisions of the primordial medullary tube, and as corresponding to the commonly received names of the German embryologists, viz., *Vorderhirn*, *Zwischenhirn*, *Mittelhirn*, *Hinterhirn* and *Nachhirn*, or their less-used English translations, viz., *forebrain*, *interbrain*, *midbrain*, *hindbrain* and *afterbrain*."

Notwithstanding several public requests for information as to the source of the Latin segmental names, the historic facts recorded in the above extract were ascertained by me only within the past week; I prefer to believe that they were unknown to the Nomenclatur Commission and to the Anatomische Gesellschaft at the time of the selection and adoption of the Latin names for the encephalic segments as given in the B. N. A. Even, then, however, since the same Latin terms were repeated in the subsequent editions of Quain (1877-1882), I am compelled to regard the transference of *metencephalon* from the ultimate segment to the penultimate, and its replacement by *myelencephalon*, as constituting a violation of scientific ethics that merits the severest reprobation.*

2. Mononymic designations of the encephalic cavities.—In August, 1882, wholly unaware of my prior suggestion to the same effect (*Science*, March, 1881), the late T. Jeffery Parker, professor in Otago University, New Zealand, proposed compounds of the Greek *zenia*, with the prepositions, etc., already employed in the segmental names; e. g., *mesocoele*, *prosocoele*, etc. Our mutual gratification and encouragement at the approximate coincidence led to a cordial correspondence that continued until his death. Besides the publications enumerated in the Bibliography of 'Neural Terms,' Parker used celian compounds in two papers on the *Apteryx* (1890 and 1892) and in the 'Text-book of Zoology,' by himself and Professor Has-

* T.
m.

segmental names have been discussed by
and in the *Proceedings of this Associa-*
28-29.

XVIII. *That, even in its earliest and crudest form, the 'system' sometimes called by my name could fairly be characterized as 'generally repulsive' and as having 'not the slightest chance of general adoption.'**—On this point it is sufficient to introduce the following letter † from Oliver Wendell Holmes, whose point of view was at once that of the literary critic and the experienced teacher of anatomy in a medical school :

"BOSTON, May 3, 1881.

"DEAR DR. WILDER: I have read carefully your paper on Nomenclature. I entirely approve of it as an attempt, an attempt which I hope will be partially successful, for no such sweeping change is, I think, ever adopted as a whole. But I am struck with the reasonableness of the system of changes which you propose, and the fitness of many of the special terms you have suggested."

"The last thing an old teacher wants, is as you know full well, a new set of terms for a familiar set of objects. It is hard instructing ancient canine individuals in new devices. It is hard teaching old professors new tricks. So my approbation of your attempt is a *sic vos non vobis* case so far as I am concerned.

"What you have to do is to keep agitating the subject; to go on training your students to the new terms, some of which you or others will doubtless see reasons for changing; to improve as far as possible, fill up blanks, perhaps get up a small manual in which the new terms shall be practically applied, and have faith that sooner or later the best part of your innovations will find their way into scientific use. The plan is an excellent one; it is a new garment which will fit Science well, if that capricious and fantastic and old-fashioned-dressing lady can only be induced to try it on.

"Always very truly yours,

"OLIVER WENDELL HOLMES."

XIX. *That, at the present stage of the subject, it is possible for any individual, however impartial and well informed, to wholly avert the possibility of misapprehension or even injus-*

* These phrases occur in the 'Minority Report.'

† As a whole or in part this notable document has been printed previously in *Science*, May 28, 1881; in 'The Brain of the Cat,' *Amer. Philos. Soc., Proceedings*, XIX., p. 530, 1881; 'Anatomical Technology,' 1882, p. 11; 'Neural Terms,' p. 237.

ticc, in attempting to indicate the attitude of living anatomists toward the simplified nomenclature.—My impartiality may perhaps be challenged, but I am at least familiar with current literature in this respect; moreover, since 1880 I have preserved all letters in which the matter is considered. Probably no one agrees with me absolutely and in every respect. On the other hand, even some frankly avowed opponents now assent to what they would have regarded as quite heretical a few years ago.*

XX. *That whatever misapprehension may exist in this country or abroad as to the degree in which the terms or principles advocated by me are endorsed by others can be justly ascribed to either unfounded declarations or intimations on my part, or to the omission of definite efforts to avert or remove such misapprehension.*—The enumeration of the conditions that led to the preparation of 'Neural Terms' included (p. 217) the following sentence: "I particularly desire to free the committees, their individual members, and the associations which they represent, from responsibilities not yet assumed by them." More or less explicit and emphatic affirmations to the same effect occur on pp. 273, 295, 299 and 301.†

XXI. *That 'most scholars are repelled by' my 'fantastic terms and defects of literary form.'*—This assertion occurs in the 'review' (No. 6), and presumably refers to the 'system' in its present or recent state. The position taken is apparently impregnable, since for every one who has declared his ad-

* In the verbal presentation of a paper at this meeting Professor Dwight designated the costiferous vertebrae as *thoracic* rather than *dorsal*, with a consistency both gratifying and encouraging.

† At the meeting of the American Medical Association in Philadelphia, June, 1897, the Section on Neurology and Medical Jurisprudence adopted the following resolution, recommended by the Committee on the Address of the Chairman, W. J. Herdman:

"*Resolved*, That the Section of Neurology and Medical Jurisprudence endorse the neural terms adopted by the American Neurological Association, the Association of American Anatomists, and the American Association for the Advancement of Science, and so far as practical recommend their use in the work of the section.

C. K. MILLS,
C. H. HUGHES,
HAROLD N. MOYER."

Since the action above recorded was taken in June, 1897, it does not, of course, apply to the subsequent adoptions by this Association at the tenth and eleventh sessions, Dec., 1897, Dec., 1898.

hesion there might be named a score who have said nothing about it. Seriously, however, it is not easy to discuss such a proposition without adducing evidence that might fairly be challenged by one side or the other. At any rate, in the present connection I shall omit my more or less intimate friends and correspondents, living and dead; Harrison Allen, W. R. Birdsall, Oliver Wendell Holmes, Joseph Leidy, and E. C. Seguin; William Browning, Joseph Collins, Elliott Coues, H. H. Donaldson, F. H. Gerrish, George M. Gould, the brothers Herrick, G. S. Huntington, C. K. Mills, W. J. Herdman, H. F. Osborn, C. E. Riggs, D. K. Shute, Sorenson, Spitzka, O. S. Strong, W. G. Tight, C. H. Turner, A. F. Witmer and R. Ramsay Wright; also past or present pupils or colleagues, T. E. Clark, P. A. Fish, S. H. Gage, Mrs. Gage, G. S. Hopkins, O. D. Humphrey, A. T. Kerr, B. F. Kingsbury, W. C. Krauss, T. B. Stowell and B. B. Stroud. I have now, I think, eliminated all whose more or less complete adoption or approval of my 'system' might be ascribed in some degree to personal considerations.*

There has lately been afforded me, however, the desired opportunity of collating the impressions of a somewhat homogeneous group of scholars, quite unlikely to have been influenced by a disinclination to antagonize my views. Through the courtesy of the author of a recent American text-book on 'The Nervous System and its Diseases,' in which the simplified nomenclature is fully and expressly employed, I have been enabled to read all the reviews of it that have thus far ap-

*Curiously enough, in the single instance of the apparent operation of personal influence, the individual was of German descent and we had met but once. Prior to our meeting in December, 1895, I prepared a typewritten list of the neural terms that had been adopted earlier in the year by the Anatomische Gesellschaft, and in parallel columns added those preferred by me. Copies of this list were sent to members of the Association as a basis for the anticipated discussion. In January the late Dr. Carl Heitzmann, in acknowledging his copy, accounted at the same time for his absence from the meeting: "My intention was to urge the acceptance of the nomenclature adopted by the German Anatomical Society, deficient as it is, simply to obtain uniformity. * * * Personally I cannot vote against you; hence I rather abstain from coming to the meetings till this matter will be settled."

My response was as follows: "Your letter affects me deeply, and were my efforts toward the improvement of anatomical nomenclature for my own sake or for the present at all it would go far to deter me from further persistence. But I never lose sight of the fact that we of to-day, and even the honored workers of the past, are few and insignificant as compared with our successors, and I do not mean to be reproached by them for failing to do what I can. Do not refrain from writing, publishing or voting against me according to your convictions. It will come out right in the end."

peared. For the sake of homogeneity I have excluded two non-medical journals, the *Revue Neurologique*, which says nothing on the subject of nomenclature, and the *Journal of Comparative Neurology*, which, upon the whole, is favorable. This leaves thirty reviews of a book intended for students; reviews written by practitioners, some of them well-known experts and also teachers of neurology. As such, upon general principles, any modification of the current terminology must be more or less unwelcome to them.

Upon the basis of their attitude toward the simplified nomenclature the reviews fall naturally into four groups, viz.: A, those that ignore the subject (8, about 27 per cent.); B, those that merely mention it (6, 20 per cent.); C, those that condemn the introduction of the simplified terms more or less decidedly (6, 20 per cent.); D, those that commend it (10, 33 per cent.). Without going so far as to reverse the Scriptural saying and claim that 'he who is not against us is with us,' we may infer that the fourteen reviewers in groups A and B were at least not 'repelled' by the simplified terms; on the contrary, many of them call attention to the clearness and accuracy of the anatomic and embryologic sections of the book where, of course, the terms are most conspicuous.

In category C I have included one that might, without real unfairness, have been left in category B; in the *Colorado Medical Journal*, after characterizing the anatomic portion of the work as 'especially excellent,' Dr. Eskridge simply expresses the 'fear that the new nomenclature will not meet with general favor.'

The six antagonistic reviews are contained in the *Pacific Record of Medicine and Surgery*, the *London Lancet*, the *Colorado Medical Journal*, the *American Journal of Insanity*, the *New York Medical Record*, and the *Journal of Nervous and Mental Disease*. I quote from the last two as highly influential and representative. The *Record* says:

"There is to be found an ample, clear and thoroughly scientific treatment of the anatomy of the nervous system. * * * We are not in thorough sympathy with nomenclatural cataclysms, and feel that frequently the old and familiar is clothed in new terms for the sake of lending an air of novelty and a form of 'science.' Still in the biological sciences nomenclature is of the most important landmarks of progress, especially when by new conceptions are gained. We believe, however, that in the new terminology the author has departed from a healthy mean, but this is, perhaps, an academic matter after all."

The foregoing contains so many qualifications as to leave its purport somewhat in doubt; indeed, one may imagine its writer, as he finished it, exclaiming, with the Congressman, 'Where am I at?'

The remarks of Dr. B. Sachs in the *Journal of Nervous and Mental Disease* are more explicit, and I should be glad to reproduce them in full; on the present occasion extracts must suffice:

"It is to be feared that the student will not be grateful for the introduction of the new cerebral terminology of Wilder and Gage. While recognizing the full merits of the new nomenclature and appreciating the benefits conferred upon the comparative anatomist and the comparative embryologist, the truth is, the student of neurology does not need it. * * * It has been suggested that children should begin the study of brain anatomy. The plan is a good one with reference to this nomenclature; the only way to acquire it is to acquire it early in life, when the cortical cells are ready for the reception of any and all auditory impressions. We have no doubt that in the course of time some of these names will be adopted by general consent; but it will be well along in the next century before the system, as a whole, will come into use."

Upon the whole I find myself less depressed by the objections of Dr. Sachs than encouraged by his almost startling forecast. He is young enough for me to venture the prediction that 'well along in the next century' he will be surrounded by colleagues and pupils who, according to my plan,* commenced the practical study of the brain in the primary school, and who, by the aid of the simplified nomenclature, learned twice as rapidly as ourselves.

Among the ten favorable reviews the most elaborate is in the *Journal of the American Medical Association* (August 20, 1898). That in the *New York Medical Journal* (May 21, 1898) concludes thus:

"We are very glad that the author has had the courage to introduce these terms, believing, as we do, in their correctness and in the need of their becoming familiar." I refrain from reading the other reviews† in Group D, mainly because the expressions therein complimentary to myself are embar-

* The desirability and feasibility of the acquisition of some real and accurate knowledge of the brain by precollegiate scholars. *Amer. Soc. Naturalists Records*, p. 31, 1896; *Science*, December 17, 1897.

† The *St. Louis Medical and Surgical Journal* (April, 1898); (Portland, Oregon) *Medical Sentinel* (April, 1898); (Detroit) *Medical Age* (April 11, 1898); *Canada Lancet* (May, 1898); *Richmond (Va.) Journal of Practice* (May, 1898); *Buffalo Medical Journal* (June, 1898); *University (of Pa.) Medical Magazine* (September, 1898); *North Carolina Medical Journal* (September, 1898).

prisingly numerous and emphatic. In view of this evidence those who contend that 'most scholars are repelled by my fantastic terms and defects of literary form' would seem called upon to either withdraw that claim as a misapprehension or modify materially the commonly accepted definition of medical and scientific scholarship.

XXII. *That 'barbarisms' constitute an objectionable feature of my 'system.'*—Upon the supposition that by *barbarisms* are here meant hybrid words, this point was somewhat fully discussed in 'Neural Terms,' p. 290. Since the criticism was offered by the chairman of the Nomenclatur Commission, Professor Kölliker, it might naturally be inferred that the list of terms adopted by that body is free from hybrid words. Yet not only does the B. N. A. contain several such, but certain of them are less euphonious than most of those for which I am responsible. Comparison is invited between the Graeco-Latin combinations in the two following groups, the first from my list, the second from the B. N. A.; in each case the Greek element is printed in italics: *Metatela*, *diatela*, *paratela*, *metaplexus*, *diaplexus*, *paraplexus*, *ectocinerea*, *entocinerea*, *hemicerebrum*, *hemiseptum*; *epidurale*, *mesovaricus*, *parumbilicales*, *parolfactorius*, *suprachorioidea*, *pterygopalatinus*,* *pterygomandibularis*, *phrenicocostalis*, *sphenopalatinum*, *sphenoöccipitalis*, *occipitomastoidea*, *squamosomastoidea*.

XXIII. *That progress toward the right solution of the questions involved is really facilitated by general denunciations of a given system or its advocates.*—The attitude of some may be likened to that of the child in the lines:

"I do not love thee, Dr. Fell,
The reason why I cannot tell,
But this alone I know full well,
I do not love thee, Dr. Fell."

History will record whether such conservatives shall rank with heroic defenders of law and order, or be rated among the Canutes of science, their utterances, in respect to nomenclature, remembered mainly as 'things one would rather have left unsaid.'

History will likewise record whether some others, includ-

* In Table IV., p. 290 of 'Neural Terms' (likewise in *Biological Lectures*, p. 158) *suprachorioidea* was printed without the first (and, as it seems to me, superfluous) *i*; also, most regrettably, there was included in the list *perichorioideale*, a wholly Greek combination.

ing, of course, the framers of the 'Majority Report,' shall be metaphorically 'hanged, drawn and quartered' as rebels, or, notwithstanding errors of judgment, credited with leaving the pathway of future students of anatomy smoother than they found it themselves.

□XXIV. *That the English-speaking anatomists who have been laboring long for the simplification of nomenclature are called upon to submit indefinitely to animadversions based upon inertia, lack of information, misapprehension, or undue deference to the adverse pronunciamentos of scientific potentates abroad.*—Speaking for myself alone, the spirit in which I prefer to meet hostile criticism is fairly exemplified in my reply (*N. Y. Medical Record*, Oct. 2, 1886, 389-390) to an article in a leading medical journal containing an egregious and inexcusable misstatement that might readily have led uninformed readers to question the soundness of all my proposals. That article, however, although upon the editorial page, was evidently prepared in haste. But such extenuation will scarcely be urged in the case of the publication numbered 6 in the list in the note on p. 18. This is a review of an article (No. 5), and to avoid confusion I shall speak of the 'article' and its 'author,' of the 'review' and the 'reviewer.'

The review contains this passage:

"Some of the peculiarities of the Wilder system are then briefly discussed [in the article], attention being called to its disregard of the ordinary principles of language formation as exemplified by Ist. The mutilation of words as by using * * * *hippocamp* * for *hippocampus major*."

It may be doubted whether scientific literature can furnish a single sentence of equal length containing so many errone-

* In the original this is 'chippocamp'. The reviewer promptly assured me that the mistake was the printer's and that it would be 'corrected wherever possible'. I assume that the copies of *Science* sent by him to others were emended like that received by me. But, so far as I am aware, no public correction has been made.

Note, April 26, 1899.—In the address as read, and as printed in *Science*, April 21, 1899, there was a commentary upon the probable effect of the non-publication of the correction. To-day, in a letter from the "reviewer," dated April 24, I learn for the first time that in *Science* for June 3, 1898 (the earliest possible date), on p. 784, foot of column two, there was printed this "*Erratum*: In the review of Wilder's System of Nomenclature, p. 716, col. 1, line 5, for 'chippocamp' read 'hippocamp.'" Since none of those who heard the Address reminded me of the "*Erratum*," it had probably escaped their notice also. A correction has been sent to *Science* for immediate publication, and copies are sent to all who have received from me the issue of *Science* containing the Address. The oversight and consequent injustice to the "reviewer" are deeply deplored by me.

ous statements and implications. For clear discrimination the several points shall be put in the form of questions :

1. In the article purporting to be the source of the criticism quoted is there mentioned either the word *hippocamp* or any other word representing a comparable etymologic category ?

In that article, beyond the reproduction of reports including the words *hippocampus* and *hippocampus major*, the single reference is as follows :

" Wilder holds that there is no longer ground for retaining *avis* with *calcar*, a term which is to be used in place of *hippocampus minor*. If this be granted, then naturally the *major* of *hippocampus major* can be dropped. The writer approves of these changes."

2. Is the reviewer himself on record as preferring the apparently alternative term, 'hippocampus major,' to *hippocampus* ?

The reviewer, as a member of our Committee on Anatomical Nomenclature, signed the first report, in 1889, which recommended the replacement of 'hippocampus major' by *hippocampus*. Since this change was also adopted in 1895 by the Anatomische Gesellschaft, I have not supposed that its abandonment was embraced within the proposition of the 'Minority Report' that the Association should 'reconsider its acts from the beginning.'

3. Has the word *hippocamp* ever been used or proposed by me in any other status than that of a national, English form (Angloparonym) of the international Latin *hippocampus* ?

The negative answer to this may be found in various publications during the last fifteen years. Among the fuller and more accessible presentations are these passages from 'Neural Terms' (pp. 231-232, 226) :

" Each anatomist prefers to employ terms belonging to his own language ; at the same time he prefers that others should employ Latin terms with which he is already familiar. *Sea horse*, *Cheval marin* and *Seepferd* are synonyms (in the broader sense, § 42), but to either an Englishman, a Frenchman or a German two of them are foreign words and unacceptable. *Hippocampus* is distinctly a Latin word, and the frequent occurrence of such imparts a pedantic character to either discourse or written page. *Hippocamp*, *hippocampe*, *hippocampo*, and *Hippokamp* are as distinctly national forms of the common international antecedent (not to invoke the original Greek (*ἵπποκαμπος*), and are readily recognized by all, while yet conforming to the 'genius' of each language."

4. tion of *hippocampus* to *hippocamp* represents so numerous in even my complete list

of neural terms as to constitute a prominent feature of what is called my 'system?'

The list embraces about 440 terms; besides *hippocampus* there are just two cases in which I have been apparently the first to Anglicize Latin words by dropping the last syllable, the inflected ending; viz., *myelon*, *myel*, and *encephalon*, *encephal* (and its compounds).

5. If, finally, every one of the 440 Latin terms happened to consist of a single word ending in either *a*, *ma*, *us*, *on*, *is*, *um*, or *ium*, and if I had proposed that English-speaking anatomists should customarily omit those syllables, would that render the 'system' open to the charge of 'mutilation of words' or 'disregard of the ordinary principles of language formation?'

For a negative answer to this question we need not look beyond the limits of the review itself, the language of which is presumed to be sanctioned by the authoritative journal in which it is printed. All of the following English words occurring therein differ from their Latin (or Latinized) antecedents in the omission of the inflected syllable: *Form*, *system*, *barbarism*, *act*, *public*, *defect*, *subject*, *natural*, *official*, *distinct*, *historic*, *artificial*, *peculiar*, *human*. If to these be added a few equally familiar, viz., *arm*, *aqueduct*, *oviduct*, *tract*, *exit* and *stomach*, it will be conceded, I trust, that *hippocamp* is in irreproachable etymologic company.

Indeed, we may now adopt the affirmative attitude and declare that among all the principles of language formation no one is better established or more generally recognized among scholars than that certain Latin words may be Anglicized by the elision of the ultima.*

I gladly forbear further direct and specific comment upon the case of *hippocamp*, but its more general aspects may be indicated in the three following queries:

1. Does scientific comity (which is comparable in some respects with what is called 'senatorial courtesy') render it incumbent upon the author of an article to refrain from disavowing responsibility for unjust statements wrongly attributed to him by a reviewer?

* This is simply one of the several well-known ways of converting Latin words into English; others are enumerated in 'Anatomical Terminology' (Reference Handbook of the Medical Sciences, VIII., 527); for all such processes of word-adoption the term *paronymy* (from *παρωνυμία*, the formation of one word from another by inflection or slight change) was proposed by me in 1885.

mentum, vermis, nodulus, flocculus, pons, lemniscus, obex, olivæ, clava and vagus?

XXVIII. *That the originality of the B. N. A. (the Nomenclature adopted at Basel in 1895 by the Anatomische Gesellschaft) is to be measured by the manifestation therein of non-acquaintance with what had been proposed or accomplished by English-speaking anatomists.*—To be more explicit, I repeat here a paragraph from 'Neural Terms' (§ 270) referring to the action of American Committees between 1889 and 1892:

"Although the specific terms included in these recommendations are few, they exemplify all the commendable features of the German report. Indeed, I fail to discover in the latter any general statement, principle, rule or suggestion that had not already been set forth with at least equal accuracy, clearness and force in the writings of British and American anatomists prior to 1895."

XXIX. *That indifference or even hostility to terminologic improvement, especially upon the part of the older generation, should be thought either surprising or discouraging.*—The first point was conceded by me in 1881:

"The trained anatomist shrinks from an unfamiliar word as from an unworn boot; the trials of his own pupilage are but vaguely remembered; each day there seems more to be done, and less time in which to do it; nor is it to be expected that he will be attracted spontaneously toward the consideration that his own personal convenience and preferences, and even those of all his distinguished contemporaries should be held of little moment as compared with the advantages which reform may insure to the vastly more numerous anatomical workers of the future."

The second point is covered by the review in the *Philadelphia Polyclinic*, which I have included in Category B (p. 30):

"While some of our friends across the Atlantic may possibly consider this too radical a departure from long-established customs, the author of the book believes that time and familiarity with the terms will justify the course he has followed."

XXX. *That action upon the general subject should be indefinitely postponed.*—This is the hour and you are the men. Let not the 'fools rush in' because the 'angels' of this Association 'fear to tread.'

XXXI. *That it is incumbent upon this Association to decide immediately upon the names for all parts of the body or even for all parts of the central nervous system.*—In a matter of such moment precipitation is to be avoided.

XXXII. *That there are contemplated by the majority of the Committee, or by any member of it, with regard to the names of the other parts of the body, changes comparable in number and extent with what have been proposed for the central nervous system.**

XXXIII. *That members of the Association should content themselves with simply awaiting the operation of the law of the survival of the fittest.*—Upon this point I quote again the brothers Herrick. The conclusion of their article, 'Inquiries,' etc., reads :

"The unification of our nomenclature is to be accomplished, if at all, by a process of survival of the fittest among competing terms at the hands of our working anatomists rather than by legislative enactment. Yet the international discussions now in progress may do much to further this end."

I trust they will pardon me for attaching the greater significance to the final concession. The subject before us is preëminently one that concerns mind rather than matter ; and its determination should be reached not so much through the operation of numbers or force as by the exercise of the highest human qualities, deliberation, self-restraint, and consideration for others.

XXXIV. *That members of this Association should defer to what is called 'general usage.'*—Of all so-called leaders, the most incapable; blundering, and dangerous is 'General Usage.' He stands for thoughtless imitation, the residuum of the ape in humanity ; for senseless and indecorous fashions, the caprices of the demi-monde ; for superstition and hysteria, the attributes of the mob ; for slang, the language of the street hoodlum and of his deliberate imitator, the college 'sport ;' and, finally, in science, for the larger part of the current nomenclature of the brain. As scholarly anatomists it is at once our prerogative and our duty to scrutinize and reflect, and to deal with the language of our science in the same spirit and with the same discrimination that we maintain in regard to the parts of the body and the generalizations concerning them.

It may be that a crisis has been reached ; that this is the turning-point. If defeat awaits us, let there be no doubt as to my attitude. — regarded as the chief offender,

* See, fr-

ed and adopted at this session.

and let the group of terms advocated by me be derided as 'Wilder's Scientific Volapük.' But if, rather, despite errors and reverses, we are in the end to overcome inertia and prejudice, then I trust that the labors and sacrifices of so many English-speaking anatomists for the simplification of anatomic nomenclature may be recognized in the designation: 'The Anglo-American System.'

Indeed, whatever be the fate of any particular set of terms, of this I am assured: that system will ultimately prevail which is approved and used by anatomists of the English-speaking race—the composite, all-absorbing, expanding, dominating race of the future.

In no spirit of national self-glorification, much less with any personal animosity, but rather as a friendly injunction to prepare for the inevitable, I shall not object if portions of this address (for all of which, be it understood, I alone am responsible) are interpreted as a declaration of intellectual independence; as a claim for the recognition of what is done in England and America upon the basis of its intrinsic value; and as a protest against an indifference which in some instances has seemed to lack even that semblance of consideration which at least was commonly maintained during the manifestation, a generation ago, of what an American scholar characterized as a 'certain condescension observable among foreigners.'

Let me conclude with a passage in more cheerful vein:

"When the first little wave of the rising tide comes creeping up the shore the sun derides her, and the dry sand drinks her, and her frightened sisters pull her backward, and yet again she escapes; and still her expostulating sisters cling to her skirts, and the rabble of waves behind cry out against her boldness, and all the depths of the ocean seem rising to drag her down. And now the second rank of waves, who would have died of shame at being the first, have unwillingly passed the earlier mark of the little wave that led them; and now you may float in your ship, for lo! the tide is full. So it is with all systems of reform; though the pioneers be derided, the great needs of humanity behind push on to triumphant acquisition of the new order of things."

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REPORT OF THE COMMITTEE ON ANATOMICAL NOMENCLATURE.

Presented by the majority (Gerrish, Huntington and Wilder).*

A.—Brief statement of reasons for preferring certain neural terms included in the report adopted at the last meeting of the Association.†

Alba (1); cinerea (2); gelatinosa (3); reticularis alba (77); caudatum (89); pallidum (108); albicans (123); entocinerea (143); intercalatum (144); and arachnoidea (208), are neuter or feminine adjectives used as substantives, and comparable in that respect with cases already discussed, viz., callosum (§13) and dura (§15); special points connected with them may be considered hereafter.

Limen (6); caput (90); cauda (91); fimbria (94); splenium (96); genu (97); rostrum (98); corona (110); tuber (124); valvula (148); frenulum (149); lingula (154); arbor (166); calamus (173); ligula (176); pyramis (181); conus (189); filum (190); cisternae (209); glomus (217); circulus (231); torcular (251), are more or less closely comparable with calcar, chiasma, tentorium, and falx (§§ 9-12) in that, even when

* This Report has also been published in the *Journal of Anatomy and Physiology*, XXXIII, Part III, ix-xv, April, 1899; in the *Philadelphia Medical Journal*, III, No. 8, pp. 417-419, Feb. 25, 1899 (edition of 22,500 copies); and (excepting sections C and D) in the *Journal of Comparative Neurology*, IX, 46-52, March, 1899.

† This portion was already written last year, but was not printed on account of the supposed necessity of having the last report ready for distribution at a certain date. The numbers in parentheses correspond with the serial numbers in that report (*Proceedings of the tenth annual session*, pp. 9, 47-53). Some of these terms are more fully discussed by the secretary of the committee

al Terms, International and National," *Journal of Comparative Neurology*, VI, December, 1896, pp. 216-352, including seven tables; also been reprinted under the title "Table of Neural Terms and Bibliography."

not absolute idionyms, their signification would be determined by the context or could be indicated by a word that need not be repeated.

In replacing "substantia corticalis" by cortex (105); "nucleus lentiformis" by lenticula (107); "corpus geniculatum" by geniculum (116, 117,) "lamina terminalis" by terma (128); "corpus trapezoideum" by trapezium (165); "nucleus emboliformis" and "n. globosus" by embolus and globulus (170, 171); "corpus restiforme" by restis (184); "formatio reticularis" by reticula (206), we simply replace phrases including adjectives that suggest resemblance to objects (simile names) by the substantive names of the objects themselves. In so doing we follow the actual example of the B. N. A. * in preferring (§6) oliva to "corpus olivare," clava to "processus clavatus," vermis to "processus vermiformis," and pyramis to "corpus pyramidale." Indeed, the logical extension of the system embodied in the retention of "corpus restiforme" when restis is available would burden anatomy with gyrus insuliformis, corpus pontiforme, and corpus hippocampoides, none of which, fortunately, has materialized.

Endyma (4). As well stated by Hyrtl ("Onomatologia," p. 200), the initial syllable of "ependyma" is quite superfluous. If, on the other hand, the qualifying genitive "ventriculi" is required, as in the B. N. A., why not "cerebri" also in order to secure absolute explicitness? As a matter of fact both endyma and "ependyma" are idionyms, and the former is as much better as it is shorter.

Habena (120), vallis (153), and acervus (218) are preferred to the diminutives "habenula," "vallecula" and "acervulus" because they are shorter; "acervulus," moreover, is a modern coinage.

* Basel Nomina anatomica. His, W.—Dje anatomische Nomenclatur. Verzeichniss der von der Anatomischen Gesellschaft auf ihrer IX. Versammlung in Basel angenommenen Namen. Eingeleitet und im Einverständniss mit dem Redactionsausschuss erläutert. *Archiv für Anatomie und Physiologie*. Anat. Abth., Supplement Band, 1895. O., pp. 180; 27 figs., 2 plates, 1895.

Gyrus subcalcarinus (61) and gyrus subcollateralis (60). These terms are recommended in place of "gyrus lingualis" and "gyrus fusiformis" respectively. The difficulty of applying the latter is well known; indeed, so vague are the resemblances implied in them that certainty can hardly be insured without resort to the rather puerile mnemonic device of associating the letter *n* in calcarinus and lingualis. But since fissura calcarina and fissura collateralis are now almost universally employed, and no new words have to be introduced, there seem to us to be several advantages and no disadvantages in designating the gyri just ventrad of the two fissures respectively by terms indicating their relative positions.

Gyrus subfrontalis (46). In the B. N. A. was adopted "gyrus frontalis inferior" to the exclusion of the common synonyms, "convolutio Brocae" and "gyrus frontalis tertius." * The question is therefore narrowed down to the relative merits of "gyrus frontalis inferior" as adopted in the B. N. A., and gyrus subfrontalis as preferred by us; and since this is a type of a large number of cases of difference between the two lists, it will be presented in some detail.

The two terms agree in being both distinctly locative names. The location of a part is a general and comprehensive attribute and, as remarked by Owen, "signifies its totality without calling prominently to mind any one particular quality, which is apt thereby to be deemed, undeservedly, more essential than the rest." Locative names form two natural groups—prepositional and adjectival. Prepositional locatives: With these the qualifying prefix, a preposition or adverb, indicates

* Both these names were rejected by the secretary of this committee in 1885, ("On two little known cerebral fissures, with suggestions as to fissural and gyral names," *Amer. Neurol. Trans.; Jour. Nerv. and Mental Disease*, XII; abst. in *Neurolog. Centralblatt*, December 15, 1885), the former as a **n** eponym and as including the needlessly long word convolutio, and the latter as a trionym and because the enumeration of the three concentric frontal arches is naturally begun with the "inferior" as with the **h**is was done by Meynert ("Psychiatry," Fig. 9); likewise analogous case of the arches about Sylvian fissure of

the location of a part relatively to some other part, more important, more easily recognized, or previously designated. Praecuneus designates a cortical area just "in front of" the cuneus; subcalcarinus and subcollateralis are prepositional locatives. Adjectival locatives: These indicate either the location of a part within some general region, or its membership of a series. Vertebra thoracalis designates a spinal segment in the thorax. Commissura anterior, cm. media and cm. posterior distinguish members of a series. Subfrontalis is an adjectival locative, and the preposition *sub* is employed as a prefix in the sense of inferior or lower; it is also a true mononymic adjective, and not a quasi-mononym like the hyphenated "infero-frontalis" sometimes employed.

B.—*Mesocoelia* (English *mesocoele* or *mesocèle*). *This single word is recommended as a name for the entire cavity of the mesencephalon, the region including the crura and the quadrigeminum.*

The following considerations apply to the general use of coelia (English *coele* or *cele*) in place of ventriculus:

(1) Its Greek origin renders it compoundable regularly and euphoniously with the characteristic prefixes already employed in the segmental names, *e. g.*, mesencephalon, etc.

(2) These compounds are mononyms, and therefore capable of inflection (*e. g.*, mesocoeliae), derivation (*e. g.*, mesocoeliana), and adoption into other languages without material change; *e. g.*, English, mesocèle; French, mesocoelie; German Mesokölie; Italian, mesocelia.

(3) The various national paronyms thus formed are likewise capable of derivation; *e. g.*, mesocelian.

(4) There is classic authority for the use of coelia in the sense of encephalic cavity. In the lexicon of Liddell and Scott *κοιλία ἐγκεφάλου* is quoted as in good and regular standing among Greek medical writers. According to Burdach ("Vom Baue und Leben des Gehirns," 1819-22, II, 301, 378, 380), Galen designated the "fourth ventricle" as *κοιλία*

ὀπισθίου ἐγκεφάλου, τετάρτη κοιλία, and ὀπισθία κοιλία (De usu partium, Lib. VIII, cxii, p. 170); the "third ventricle" as μέση, τρίτη κοιλία (idem. IX, iii, 172); and the "lateral ventricles" as προσθία κοιλία (De odoratus instrumento, II, 110). Coelia is then certainly not "new." *

(5) These ancient usages are assumed to be familiar to most anatomists, who therefore should recognize the compounds with little or no hesitation.

(6) The compounds are so euphonious and so obviously correlated with the segmental names as to be learned and remembered easily even by general students and by such as may not have had a classical training.

(7) In recent times coelia has been independently proposed by two anatomists, teachers as well as investigators. †

(8) It has been adopted more or less completely by four of the older American neurologists, C. K. Mills ('97), Henry F. Osborn ('82, '84, '88), E. C. Spitzka ('81, '84), and R. Ramsay Wright ('84, 85); and unreservedly by eight of the younger, W. Browning, T. E. Clark, P. A. Fish, Mrs. S. P. Gage, O. D. Humphrey, B. F. Kingsbury, T. B. Stowell, and B. B. Stroud.

(9) Coelia and its compounds are idionyms, *i. e.*, used in no other sense in normal vertebrate anatomy; hence, unlike ventriculus and its compounds, they are free of ambiguity. This argument is stated last because it seems to the committee of comparatively slight importance. Theoretically, of course, ventriculus (encephali) might be mistaken for ventriculus (cardiae *s.* cordis). Practically, however, the context would almost infallibly obviate misapprehension. Hence the

* Dr. Achilles Rose, of New York City, informs the secretary of the committee that in the modern Greek treatise on anatomy by Παπαϊωάννου (Athens, 1888-90, 3 vols.) the encephalic cavities are designated by *αὐτὰ πλάγια κοιλία; τρίτη ἢ μέση κοιλία; τετάρτη κοιλία.*

† The secretary of this committee, March, 1881; Prof. T. Jeffery Parker, of Otago, 1st August, 1882; in addition to the three publications enumerated by of "Neural Terms," there should be named his *Philos. Trans.*, 1891 and 1892) and Parker and Has-

absolute unambiguity of coelia and its compounds would not in itself justify its replacement of ventriculus. It would be a *causa vera*, but hardly a *causa sufficiens*.

The special arguments for the adoption of mesocoelia in advance of the other coelian compounds are four :

(1) There is substantial agreement among anatomists in recognizing a definitive encephalic segment under the title mesencephalon ; this cannot yet be said of the other regions.

(2) The cavity of this segment has no common ventricular designation like "quartus," "tertius," and "lateralis."

(3) The terms ventriculus mesencephali or v. mesencephalicus (English, mesencephalic ventricle or cavity), are seldom used and are somewhat clumsy. Even less convenient are the phrases "aquaeductus cerebri Sylvii" and "iter a tertio ad quartum ventriculum."

(4) The abbreviations, iter and aqueduct, while sufficiently descriptive of the adult conditions in man and other mammals, are quite inappropriate to the "vast and spacious cavity" of the embryonic mesencephalon, and to the lateral extensions in frogs, reptiles, and birds.

C.—*Names of bones and muscles identical with those in the B. N. A.*

In the B. N. A. the special names under Osteologia and Myologia number about 885 and 350 respectively, total about 1235. Of these the committee recommend the adoption of 181 (120 of bones, 61 of muscles).

In the 17 cases of difference from the B. N. A. the committee believe the terms preferred by them will, upon due reflection, commend themselves to the large majority of English-speaking anatomists.

Columina vertebralis.*
Vertebrae thoracales.
Vertebrae sacrales.
Atlas.

Vertebrae cervicales.
Vertebrae lumbales.
Foramen intervertebrale.
Processus spinosus.

* Read these names across and back.

Vertebra prominens.
 Thorax.
 Sternum.
 Ossa cranii.
 Condylus occipitalis.
 Os sphenoidale.
 Foramen opticum.
 Foramen ovale.
 Processus pterygoideus.
 Canalis pterygoideus [Vidii].
 Pars mastoidea.
 Foramen mastoideum.
 Canalis facialis [Falloppii].
 Incisura jugularis.
 Processus styloideus.
 Pars tympanica.
 Processus zygomaticus.
 Os parietale.
 Sinus frontalis.
 Lamina cribrosa.
 Processus uncinatus.
 Os nasale.
 Maxilla.
 Tuber maxillare.
 Os palatinum.
 Ramus mandibulae.
 Processus condyloideus.
 Os hyoideum.
 Calvaria.
 Vertex.
 Occiput.
 Orbita.
 Sutura sagittalis.
 Scapula.
 Acromion.
 Processus coracoideus.
 Extremitas sternalis.
 Humerus.
 Fossa olecrani.
 Fossa radialis.
 Processus styloideus.
 Olecranon.
 Processus styloideus.
 Metacarpus.
 Ossa sesamoidea.
 Foramen obturatum.

Promontorium.
 Costae.
 Cavum thoracis.
 Os occipitale.
 Sinus sphenoidalis.
 Foramen rotundum.
 Foramen spinosum.
 Fossa scaphoidea.
 Os temporale.
 Processus mastoideus.
 Pars petrosa [Pyramis].
 Aquaeductus vestibuli.
 Fossa jugularis.
 Canalis caroticus.
 Squama temporalis.
 Fossa mandibularis.
 Os frontale.
 Os ethmoidale.
 Crista galli.
 Os lacrimale.
 Vomer.
 Sinus maxillaris.
 Processus alveolaris.
 Mandibula.
 Angulus mandibulae.
 Processus coronoideus.
 Cranium.
 Diploë.
 Frons.
 Palatum durum.
 Sutura coronalis.
 Sutura lambdoidea.
 Spina scapulae.
 Incisura scapulae.
 Clavicula.
 Extremitas acromialis.
 Caput humeri.
 Fossa coronoidea.
 Radius.
 Ulna.
 Processus coronoideus.
 Carpus.
 Phalanges digitorum manus.
 Os coxae.
 Acetabulum.

Fossa acetabuli.	Incisura acetabuli.
Fossa iliaca.	Os pubis.
Eminentia iliopectinea.	Pelvis.
Symphysis ossium pubis.	Arcus pubis.
Femur.	Caput femoris.
Trochanter major.	Trochanter minor.
Fossa trochanterica.	Linea aspera.
Tibia.	Fibula.
Patella.	Tarsus.
Metatarsus.	Phalanges digitorum pedis.
Ossa sesamoidea.	
Musculus trapezius.	M. levator scapulae.
M. iliocostalis.	M. longissimus.
M. masseter.	M. temporalis.
M. digastricus.	M. stylohyoideus.
M. mylohyoideus.	M. geniohyoideus.
M. platysma.	M. sternohyoideus.
M. omohyoideus.	M. sternothyroideus.*
M. thyrohyoideus.*	
M. subclavius.	Diaphragma.
M. rectus abdominis.	M. pyramidalis.
M. cremaster.	Ligamentum inguinale [Poupart].
M. deltoideus.	M. brachialis.
M. anconaeus.	M. pronator teres.
M. flexor pollicis longus.	M. pronator quadratus.
M. brachioradialis [supinator longus].	
M. extensor digitorum communis.	M. supinator.
Musculi lumbricales.	Musculi interossei dorsales.
Musculus iliacus.	M. tensor fasciae latae.
M. quadratus femoris.	M. sartorius.
M. quadriceps femoris.	M. rectus femoris.
M. vastus intermedius.	M. articularis genu.
M. biceps femoris.	M. semitendinosus.
M. semimembranosus.	M. extensor digitorum longus.
M. peroneus tertius.	M. peroneus longus.
M. peroneus brevis.	M. gastrocnemius.
M. soleus.	Tendo calcaneus [Achillis], †
M. popliteus.	M. flexor digitorum longus
M. flexor hallucis longus.	M. extensor digitorum brevis.

*In the B. N. A. these names are sternothyroideus and thyrohyoideus. While not questioning the etymologic accuracy of these forms the committee believe that, as with chorioideus *versus* choroideus, the extra vowel and syllable are needless and not likely to be pronounced even if retained.

†Through a clerical error for which the secretary of the committee holds himself responsible, the type-written copies of the original manuscript had this term M. tendo calcaneus (Achillis), and the error was repeated in the *Journal of Anatomy and Physiology* and in the *Philadelphia Medical Journal*.

M. abductor hallucis.
 M. flexor digitorum brevis.
 Musculi interossei dorsales.
 Canalis adductorius [Hunteri].

M. adductor hallucis.
 Musculi lumbricales.
 Musculi interossei plantares.

D.—*Names of bones and muscles unlike those in the B. N. A.*

Axis *for* epistropheus; Sacrum *for* os sacrum; Coccyx *for* os coccygis; Foramen magnum *for* foramen occipitale magnum; Os malae* *for* os zygomaticum; Zygoma *for* arcus zygomaticus; Ossa membri thoracalis *for* ossa extremitatis superioris; Ossa membri pelvici *for* ossa extremitatis inferioris; Ilium *for* os ilium; Ischium *for* os ischii; Tuber ischii *for* tuber ischiadicum; Spina ischii *for* spina ischiadica; Musculus latissimus *for* latissimus dorsi; M. sternomastoideus *for* sternocleidomastoideus; M. biceps *for* biceps brachii; M. triceps *for* triceps brachii; M. accessorius *for* quadratus plantae.

B. G. WILDER, Secretary of the Committee on Anatomical Nomenclature.

D. S. LAMB, Secretary of the Association.

*As in John Bell's "Engravings," etc. First American from second London edition, Philadelphia, 1817. Part 1, Plate 1, Fig. 1, p. 33.

THE DEFECTS OF OUR PRESENT METHODS OF TEACHING ANATOMY IN OUR MEDICAL SCHOOLS.

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Upon looking over the membership of the Association of American Anatomists, the individuals seem to fall into one of two classes: (1) scientific investigators; (2) those engaged in teaching.

Each group overlaps the other, for in a country as crude as ours it too often happens that we harness the race horse to the cart; the scientific investigator with soaring thought and delving brain must keep himself buckled down to the common level in order to teach elementary facts to the beginner. We should not, however, in our medical teaching be too rigorous in excluding advanced ideas, for it should be recognized that we have no right to reject any class of facts as absolutely impracticable, because the commercialism of to-day is the theoretical of yesterday; the ultra-scientific of to-day the commonplace of to-morrow.

I had thought, therefore, it might subserve the interest in our meetings if on this occasion some definite topic were proposed sufficiently comprehensive to concentrate the attention of our composite membership, realizing that the question is a practical one, limited to the question of teaching anatomy—not what we might wish our students to know, but what they can fairly accomplish, taking into consideration all that an intelligent mind might be expected to grasp in the time allotted, under modern methods, with skilled teaching, making allowance for the class of practitioner asked for by popular demand, with due regard for the scientific basis of knowledge, and for the dignity and honor of our noble profession. To me falls the ungrateful and ungracious mission of setting forth, somewhat sententiously, certain defects in our present methods, leaving to the eminent authorities who are to follow me the still more difficult task of devising means to correct them.

The first defect we have to contend with is *the time limit*. I shall take it as axiomatic that the average young man

should be prepared to start in practice not later (nor much earlier) than his twenty-fourth year; the last year being spent in a hospital as resident, or failing this in outdoor dispensary work, or in actual practice under the eye of an older physician. This brings his graduation in medicine into his twenty-third year. Four years in a medical school, four years of liberal college education, three years in a preparatory department, twelve years in all, makes him begin his training for medicine in his twelfth year; for the majority a *reductio ad absurdum*. The result of raising the standard of our colleges is to bring the preparatory schools to a higher level, from which the majority make a short cut into the medical school, thus losing the benefit of the liberal education of the college. For those who take the full twelve years of preparation with the advantage of the optional courses now offered in biology, it is comparatively easy to distribute the necessary curricula; but what are we to do with by far the larger number who have only high school attainments. I commend this difficulty to those who are to follow me, for solution.

Appurtenant to the same question I cannot omit the opportunity of calling attention to the lack of appreciation of the higher education among the laity, as well, alas, as among our own profession. Success, unfortunately, does not depend alone upon medical knowledge; the laity are not capable of judging of the acquirements nor requirements of the physician, and a knowledge of human nature, an agreeable personality and tact, coupled with a proper realization of the *vis medicatrix naturae*, will go further in many cases to make the successful practitioner than a depth of scientific *præcognita*. Nor is our own profession without blame. I think I can safely assert that the greater number of the pre-eminent medical men of to-day throughout this country are not, and for a long time will not be, college graduates, and many in their hearts despise the additional training, and will continue to do so so long as many of the higher positions are the rewards of the influence of money, medical faction or party politics rather than of sound scholarship.

The *second defect* is the relation of preliminary courses to the medical school. It is obvious that in the latter, the fourth year should be absolutely devoid of theoretical studies and should be devoted to their clinical application and practice exclusively. The third medical year should be, *inter-alia*,

predestined to applied anatomy, leaving descriptive anatomy and biology for the two earlier courses except in so far as may be taught in the preparatory schools. As our immediate object, I take it, is the teaching of human anatomy for the practitioner, elementary comparative anatomy, histology and embryology had far better be studied as preliminaries so that they may be used as aids to impress and illustrate the human structure; but the cost of apparatus, the necessity for trained teachers, such as none but our more advanced colleges possess, here stand in the way. It is impossible to throw the burden of these upon the high schools, so that they must be crowded into the medical school in some fashion, upon an anatomical roster already overcrowded. Just there comes in another defect in our present methods, for which we have no one to blame but ourselves, and that is the comparative neglect into which the study of anatomy has fallen; for it has lost not only its absolute but its relative importance, because in the rush of modern science other branches have pushed it aside, so that, though the most difficult of all and the foundation of the whole superstructure, it is neglected, disregarded, nay even despised. I have heard an operator of eminence declare "We lose our anatomy when we get below the deep fascia," and, judging from some of his work, I think he does. Recognizing the importance of anatomical knowledge, I would premise that it is impossible, in the modern well-filled curriculum, to sandwich in with advantage courses in embryology and comparative anatomy, or even elementary histology. I have always thought in the latter well-prepared slides for study would be of more advantage than the present motley of imperfect technic of section cutting and staining. These three branches (embryology, comparative anatomy and histology) should have a large share in the senior and junior years of a college course prefatory to medicine, taking the place of the higher mathematics and the *mere reading* of ancient classics, in contradistinction to their analytic study of the earlier years. Should work in these be thrown upon the medical school one of two courses is inevitable, (1) to add one more year to our medical curricula, or (2) to throw out from the courses now constituted, instruction in what we now broadly call the specialties; trusting, as is in fact more rational, to post-graduate study to perfect the graduate in the particular line he may happen to choose. Unfortunately the same objections

hold as to these specialties as to our foundation studies, that opportunity for their acquirement only comes to those near to educational centers, and while some few of scientific turn may investigate after graduation by far the greater proportion, either from lack of opportunity or lack of desire, or because the cares of practice are so engrossing or the struggle for existence so keen, that what is not given them up to the time of graduation is seldom acquired afterwards. For instance, we have noticed that many of the older men not versed in the technic of the microscope have but little interest in bacteriological or hygienic investigations so far as they are dependent upon the use of that instrument. I hope, therefore, in the near future the three branches of which I am now speaking will be considered as not merely matters of interest but of absolute necessities in the later college years, leaving to the medical course a rapid review, so that they can be used for purposes of illustration and emphasis in the teaching of human anatomy.

The didactic method has been and is still the main stay of instruction in anatomy in our medical schools simply because in the days when books were scarce and scholars few and laboratories were not in existence it was the readiest method of imparting knowledge at long range independent of the class numbers. To day the kindergarten methods are gaining ground, the eye and the touch must be instructed rather than the ear, though I doubt if we can ever do without the eloquence and the enthusiasm, the force and the example of the didactic teacher pointing the way as to what is of importance, giving rapid reviews of regions as a whole, demonstrating relations rather than merely descriptive talks, and continually refreshing his own word pictures by continuous work in the dissecting room. Of the preeminence of the didactic lecture to the neglect of the dissecting room I have written elsewhere. Allow me to quote from a monograph upon this subject read before this honorable association in 1893.

"I have already disclaimed any intention of detracting one iota from the value of lectures, but really how opportune if the phonograph could be utilized for this purpose! let the most scientific of this society write out a series of lectures which could be spoken into the instrument by the member. Then a tyro could turn the crank, and a delighted audience the most perfect of courses,

and these could be multiplied indefinitely so that each medical school could be supplied on demand, while thereby could be secured that uniformity of nomenclature which has harassed the minds and hearts of our members for a considerable season."

And again, page 4 :

"I have endeavored to point out some of the more glaring defects in the anatomical room which stand in the way of its improvement.

"(1.) It is subordinated to the lecture method, which rightly should be subordinate to it.

"(2.) It is too often repulsive and inaccessible.

"(3.) It is not managed with the precision that we find in other departments.

"(4.) The teaching facilities are rarely what they should be, and should be supplemented by an extensive museum, ready of access, under proper regulations, to the student, who should be allowed to handle the specimens himself.

"(5.) The teaching should be personal and demonstrative, rather than didactic.

"(6.) The test should be a practical knowledge of the cadaver, rather than of merely theoretical data.

"(7.) A proper record of all anomalies and pathological lesions found should be kept, and the invaluable specimens added to the teaching facilities of the various departments of the school."

Following upon the mastery of structure there is no doubt that the illustration of function will make further impression upon the mind. In fact, for the average practitioner applied anatomy or the correlation of structure and function is the consummation of the whole study. The defect in its use is that an attempt is made to employ, as a means of lightening the labor of acquirement, a short cut which ends in short coming, and abbreviation which ends in quick forgetting, because the true foundation is wanting.

The defects of the teacher may be summed up hastily :

(1.) A want of enthusiasm in the subject no deeper than bread and butter considerations.

(2.) A devotion to clean didactic rather than to somewhat ill smelling cadaveric work and demonstration.

(3.) A lack of forensic ability sufficient to keep his audience awake.

(4.) A want of appreciation of the needs of his students through lack of personal contact and association with them; and a lack of appreciation of his own failures for similar reasons.

(5.) I need not say that with the formidable array of subjects as outlined he needs to be well educated, though we all appreciate that the gift of imparting is not always given to the greatest scientists.

The defects in our terminology are partly the result of bad habit and partly that of custom. Until we get all of our teachers thoroughly grounded in the elementary studies much effort in this line is useless. What is the use of insisting upon terminologic consistency when our teachers do not pronounce the common Latin words, not to say the ordinary English terms, correctly, and frequently clothe their thought in stilted ungrammatical phrases. Passing this; in the interest of consistency I would prefer to adopt the terminology now used in the latest edition of some book most current in the majority of the English speaking medical schools the world over, Gray's or Quain's or Morris' Anatomy, for example, giving notice to all English word-coiners, the world over, that all new names or terms must conform to some most approved, modern scientific pattern.

In concluding this brief resumé of some of the defects in the teaching of anatomy in our medical schools, I must confess to a sense of injury experienced from the contemplation of the neglect into which our branch has fallen. Most of the errors in actual practice are due to a lack of knowledge of practical applied human anatomy. Yet its details are despised, and the utmost enthusiasm, the finest museum and laboratory facilities, the latest apparatus, the costliest buildings are lavished on the collateral branches, whilst the practical knowledge of the human body which is the end all and by far the most useful, seems to be more and more lost sight of.

The subject was subdivided for discussion into the following:

1. Preparatory education.
2. The value and place of General Biology and Comparative Anatomy.
3. Histology and Embryology in the medical course.

4. The relative value of didactic methods.
5. Practical Anatomy and how to teach it.
6. The order of topics.
7. The correlation of structure and function in teaching.
8. The use of charts and blackboards.
9. The qualifications requisite for a teacher of anatomy.
10. The desirability of terminologic consistency.

DR. F. H. GERRISH, Bowdoin College, opened the discussion by stating the *order of topics*, which, after many years of experience with it, seemed to him the best to follow in a two-years' course in a medical school. The elementary tissues should come first, because without a knowledge of them the descriptions of organs are unintelligible. Then should be introduced the viscera, which are usually left until the end of the second year. The reason for this early treatment of them is that the pupil is studying physiology, as well as anatomy, and the former deals very largely with the viscera. That there may be a reasonable economy of the student's time, the anatomist and physiologist should arrange to have the pupil well grounded in the structure of every organ before its function is treated of. There is no valid objection to this plan, and practically it is most satisfactory to all concerned, not only saving time and effort, but making the pupil's work much more interesting. It is not at all incompatible with the simultaneous study of the bones and joints, and practically Dr. Gerrish so conducts his course. In the second year are taken up the muscles, fasciae, vessels and nerves, topographic anatomy completing the work.

Concerning the *relative value of didactic methods* he said that the plan which was formerly nearly universal it is now proposed to discard altogether. In the old times, which have not entirely disappeared, the rule was, all lecturing and a little dissecting; the new plan is to abolish lectures and apparently all other didactic methods, and to keep the student constantly in the dissecting room. The truth is between these extremes. A student set to dissect a human body will waste time, effort and expensive material unless he has had some previous instruction concerning the things with which he has to deal. The maxim, "Let the eye go before the hand, the mind before the eye," has no application to such a one's case. Set a

man down in a foreign city, of whose geography and language he is utterly ignorant, and he has more facilities for becoming acquainted with the place than has a green student for learning human anatomy in the dissecting room. The correct method is to teach him beforehand by didactic and demonstrative means what he should expect to find and how to find it. For example: supposing that the bones and joints have been learned, the muscles naturally are taken next, as being the necessary prelude to vessels and nerves. First: the student should be taught the physiologic anatomy of the muscles. Then they are studied in groups, perhaps best made on a basis of function. The name of each muscle is learned, the meaning of the name, the synonym (if any) and its meaning, the situation of the muscle, its origin, direction, insertion and action. Illustrations are given by means of the skeleton, with attachment areas indicated in colors; black-board drawings of great size are made to show outlines; casts from dissections are displayed; and demonstrations upon the dissected subject, and, when practicable, on the living model, are given to small groups of pupils, so that each can see clearly and aid sight by touch. The student is encouraged to learn all that he can on the topic in hand from his text-books. Finally comes a recognition-exercise on the dissected cadaver, in which he is required to name the muscles in the part which is assigned to him. With this equipment he is fairly qualified to dissect; without it, he is bound to blunder and waste.

Some of these preliminaries to dissection are necessarily didactic. They can be accomplished by recitation in large part; but every teacher finds that the text-book, whatever it is, is not quite what every student needs—it requires simplification here, expansion there, illustration of a familiar kind in many parts. This must always be the case on account of the individual differences of students—the teacher must adapt his method of presentation to the time, the place, the capacity of the pupil, the part under consideration. Now, whether the explanations and illustrations are given during a recitation or in some other exercise, they are necessarily in the form of lecture; and, consequently, it is not wise to inveigh against the lecture, unless we limit the term to formal phrases pronounced after the manner of an oration. It would be a pity to prohibit the lecture altogether, for it has an important field,

which nothing else can fill; but it should be confined to the work of blocking out new subjects and explaining matters which accessible books do not sufficiently clarify for the student.

The recitation is a very valuable means of instruction. It presents an opportunity for the correction of erroneous impressions; it requires the student to work for himself, which the old-time lecture does not; it is a stimulus to pride, which few men can afford to dispense with. But the teacher should never permit the pupil to learn anything by rote—he must insist upon the creation of mental pictures of the things studied, and the description of these in the student's own terms.

The superiority of free-hand drawing on the blackboard to the use of the most perfect charts was emphasized. An elaborate picture presents many details to the mind all at once, and while one of these is being pointed out, the others are probably attracting the hearer's attention. But when the teacher draws on the board, he shows but one thing at a time, and develops the picture step by step, and the pupil's mind is engaged entirely with what is for the moment presented to both eye and ear. On this account a crude drawing, built up before the class, is vastly more helpful than the most artistic picture which is finished before being shown.

In closing, Dr. Gerrish recommended, as of the highest value, the method of examination which requires demonstrations upon the cadaver and the living model.

DR. GEO. S. HUNTINGTON, Columbia University, New York City. Manuscript not furnished.

The following contribution to the discussion is from Dr. IRVING S. HAYNES, Cornell University Medical College.

A practitioner in medicine wants to know the relative position of the various organs and structures. He can obtain such information only at the dissecting table. As a rule his opportunities for dissection are restricted to his collegiate course, and as a rule he has time only for the regular required course of dissecting the subject twice. How important it is, then, that his time should be utilized to the best advantage for his future needs. Time spent in dissecting muscles alone seems

to me almost wasted. The student can do his muscles just as well and at the same time dissect out everything in the part as to recklessly cut away all but the muscles themselves.

When he dissects for everything he begins at once to comprehend the construction of the human body. If he dissects only for muscles, the important relations of the other structures are entirely lost.

As regards the difficulty in learning about the dissection when everything is saved, we have had no trouble on that score. The student knows he has to learn it if he is to pass, and he learns it. It may be only indifferently, perhaps, but all the same there remains in his mind a comprehensive view of the entire part he could not obtain by dissecting the various chief constituents separately.

The plan of teaching practical anatomy that we have followed some years is this:

The first-year class is divided into sections A, B and C. These sections are assigned work, as, for instance, take section A.

Section A begins work in anatomy with the study and recitation upon the bones of the head and neck. These recitations are given twice each week. At the same time section A is given a demonstration upon the anatomy of the head and neck once a week. These section demonstrations are intended to instruct the student in the *way* he should dissect, the structures he should find, and the best way to show them.

After the section has had two weeks' training in this preparatory work, it is assigned to the dissection of the head and neck. The other sections take up the extremities in the same way.

The student's dissection is carefully supervised all the time, and at its completion he has to pass an examination upon it. This examination includes the grade of dissection itself, as well as the student's knowledge of it.

These section demonstrations for the first year run through the entire course. After reviewing the head and neck and extremities, the joints are taken up fully, and later the first-year students are given a short course on the viscera.

The second-year students have section demonstrations on the viscera and smaller parts of the head, eye, ear, etc., and their course in dissection embraces all that of the first year, and in addition the dissection of the viscera.

Besides possessing all the qualifications recognized as necessary for teachers in general, the instructor in anatomy should be one who is engaged in the active practice of his profession.

The object of medical schools is to graduate successful practitioners in medicine and surgery.

The subject of anatomy underlies all the other subjects of the medical curriculum. Its facts are in themselves interesting to the instructor, but to the student they present a most uninviting aspect. If these facts are clothed, however, with the charm of a practical application to other subjects that the student himself recognizes as being the aim and object of his medical study and future practice, then these dead and dry anatomical facts take on new features; they become alive and will live forever in that student's mind, although their special names will soon slip from his memory.

The teacher of anatomy then must be engaged in the active practice of medicine and surgery; he must come in daily contact with disease and injury in order to make a practical application of the subject matter of anatomy. Unless the teacher's inclinations and tendencies are thus guided and limited by the actual needs of medical practice, he will unconsciously drift away into lines of thought more or less speculative, his teaching will become more or less technical, and he will give undue importance to abstruse subjects, which, although interesting to him, may have no direct relation to the student's general education.

THE ORIGIN OF NUMERICAL VARIATIONS OF THE VERTEBRAE.

BY THOMAS DWIGHT, M. D., HARVARD MEDICAL SCHOOL.

[This was a preliminary paper, publication of which was reserved. It aimed to disprove Rosenberg's views.]

A NEW METHOD OF CUTTING GROSS SECTIONS OF THE CADAVER.

BY DR. IRVING S. HAYNES, CORNELL UNIVERSITY
MEDICAL COLLEGE.

For the past two years I have been using a method of cutting gross sections of the cadaver which is so simple and

useful and produces such clean and sharp sections that I have ventured to take up enough of your time to present it to you. I do this especially as I have seen nothing in print which would lead me to think that any one else was using the same plan.

Heretofore the best way of securing gross sections of the body has been by freezing the subject, and using a saw for cutting the desired sections. It is unnecessary to say that this method, while very valuable, leaves much to be desired. It requires a freezing plant, not always available, and the sections themselves do not show that clean-cut surface so necessary for easy study.

The absence of a freezing plant in connection with the dissecting room of the New York University led me, two years ago, to consider if there was not some other way by which sections could be made.

I will not take up your time to give the details of my first experiments, but will conclude by stating the method as at present used.

The subjects should be under four years of age—those of about two years are the best for our purpose.

Each cadaver should be injected, preferably through the right common carotid, with a four per cent. solution of formalin in water. After an interval of twelve hours, a second injection of an eight per cent. formalin solution should be given. The subject can now be placed in a tank containing a four per cent. solution of formalin, and left there for a period of two weeks before used. If needed sooner for sections, a third injection of the stronger solution of the formalin should be given in the artery, and also into the abdominal cavity through the umbilicus. If the sections are to be made of the thorax, it is a good plan to fill the lungs also, through the trachea, with the eight per cent. solution.

To cut the sections. Place the cadaver on a firm board, or on a more elaborate form of support; it needs to be held firmly. Use a long, wide but thin-bladed knife made of the best steel.

Cut firmly and quickly, with a sawing movement, down through the part. Sections can be made of the head and body in the middle line; * , thorax, abdomen and pelvis vertically or * portion of the bone is met with the* it does not disturb

the section very much to carefully cut through it with a short saw, as, for instance, in cutting sections of the pelvis, you can cut through most everything with the knife except immediately about the acetabulum; if this is sawn through, the internal sections can be completed with the knife.

Sections cut after this method are as clean, sharp and distinct as if cut for a microscope. The individual organs stand out with remarkable clearness. The parts, moreover, are hardened *in situ* and show the normal relations. Furthermore, they will keep indefinitely in a four per cent. formalin solution, and can be used over and over for section teaching.

ON THE MORPHOLOGY OF THE DIGESTIVE TRACT OF THE CAT.

BY DR. FRANKLIN DEXTER, HARVARD MEDICAL SCHOOL.

[Published in Archiv für Anat. und Phys., Anat. Abtheil, 1899.]

In the discussion DR. BLAKE said: "One of the many points in Dr. Dexter's paper that has interested me especially is the fact of the presence of the abdominal contents in the cavity of the umbilical cord. It seems to me that this has a bearing on the occurrence of umbilical hernia in the infant as well as in other animals. In several of the domesticated animals there is often, if not as a rule, present a protrusion at the umbilicus which subsequently disappears."

STUDY OF THE NORMAL TIBIA.

[Abstract.]

BY DR. ALES HRDLICKA, NEW YORK CITY.

Observations and measurements were made on about 2,600 tibiae, almost 2,000 of which were bones of whites, 80 the bones of negroes, and the remainder the bones of North and Central American Indians.

The study of the bones of whites and negroes was carried on at the College of Physicians and Surgeons, New York, on collection of Prof. George S. Huntington; the Indian e were principally studied at the American Museum of

Natural History, New York, and partly at the National Museum, Washington, and at the Peabody Museum, Boston.

The objects of the study are : 1. Contribution to the knowledge of variations of the bones ; 2. Study of correspondence of different variations of the various parts of the skeleton ; 3. The tracing, so far as possible, of the causation and tendencies of variations found ; 4. The establishing of some standards, if possible, for comparisons.

The study presents numerous difficulties, the principal of which is due to a deficiency of data about many of the bones. This difficulty has been largely foreseen and diminished in Prof. Huntington's collection by a system of keeping records about the bones. A good system of records and provision for a proper identification of every individual specimen is, in the author's opinion, the main requisite and the most valuable feature of every large osteological collection. (A simple scheme for such identification and record keeping will be given in the detailed publication.)

Of the results of the study, in the main, only generalities are mentioned, the details, particularly those of the measurements, being left for print ; the results are as follows :

The tibia differs much in shape, but the innumerable little variations can be arranged in a number of distinct *types*. The principal, though not the only differences in the bone, occur in the shape of the shaft. They are best appreciated when we study the shaft in a transverse section, particularly at the middle of the bone. The lower third of the shaft of the tibia is not so well differentiated as the middle, while the shape of the upper third is, in over a half of the cases, more or less disturbed by the oblique ridge.

There are six main types of the shape of the shaft at the middle of the tibia and one or another of these types was clearly recognizable in fifty-five per cent. of the bones of the whites, the remaining forty-five per cent. of the bones showing intermediary stages. In the majority of cases tibiae do not fully develop their type until after the complete union of their epiphyses. Negro bones show variety which may be due to some extent to admixture. Indian tibiae are much more homogeneous in their shape than either those of whites or of negroes, particularly the former. No marked difference was found in the shape of the tibiae of whites of different nationalities.

The six types of the shape of the shaft of the tibia at the middle are as follows: 1. Closely approaching a right equilateral triangle, found in 18.2 per cent. of white tibiae. 2. Closely approaching a lateral triangle, the posterior surface not facing directly backward, as in the previous type, but backward and outward, found in 14.9 per cent. of white tibiae. 3. Shaft more or less triangular with the external surface markedly concave, in 9.1 per cent. of the tibiae of whites, very prevalent among Indians, almost absent among negroes. 4. Shaft quadrilateral, posterior surface being divided by a marked vertical ridge into two lateral surfaces, in 5.1 per cent. of whites, mainly in males. This shape is somewhat less frequent in negroes, but considerably more frequent in Indians. 5. Posterior border blunt or effaced, posterior half of the shaft oval, in 5.2 per cent. of whites, mainly in females. 6. Internal surface flat or slightly convex, external and posterior surfaces quite convex, external border may be effaced; almost absent in whites, never met with in Indians, frequent in negroes (10.9 per cent.). Transverse sections of this type are very similar to those of the tibia of the gorilla. A little over five per cent. of all the white bones examined showed these various types in a perfect form (demonstration of whole bones and of sections).

The signification of the various shapes is obscure, but the author will follow a large number of the individuals to whom the bones belonged, and try to learn their vocation to see whether possibly this may not have had some effect in favoring the development of certain shapes. There are indications that even with such a knowledge we will be much at a loss to explain the different shapes. Some such indications are the occurrence of all the shapes in women, and that in proportions not differing greatly from those of men; the weak bones differ quite as much as the strong bones, and there are found fully evolved types in young adults, in whom occupation or habits of life have not yet exerted much influence on the skeleton. The third type is found to be accentuated in some curved bones, but over thirty-five per cent. of curved bones did not show any concavity of the external surface to speak of.

The shape of the anterior border or crest of the tibia was found to vary from an almost straight line to a marked double curved figure. The causes of the different forms could not be definitely traced, but the very curved crest seems to be at least partly due to muscular action.

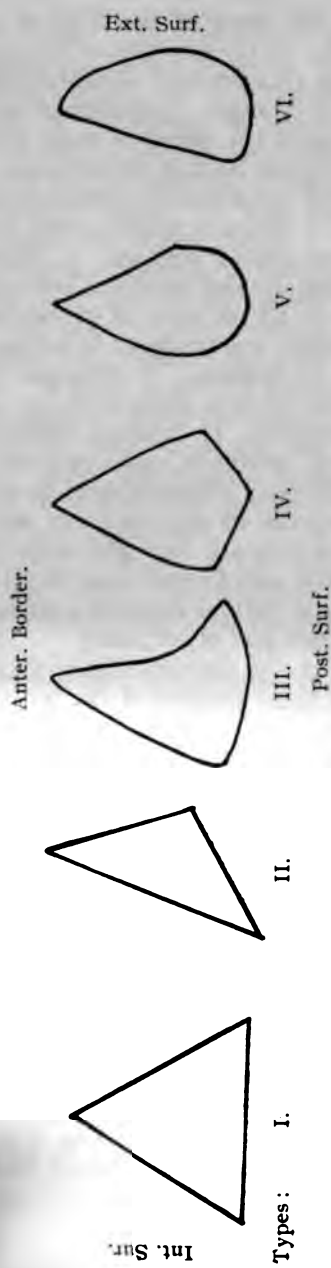


Illustration of the six types of the shape of the shaft of the Tibia. (Partly schematic.)

The *measures* of the tibia are all subject to numerous variations, and they differ not only in different individuals, but also in the two bones of the same body. The tibia is in average both longer and stronger in the male. In numerous instances the left tibia is the longer.

As to diametrical measurements, the author advocates that a preference be always given to those of the measured middle of the tibia over those at the height of the nutrient foramen. At this latter height many of the bones are influenced by the overgrowth of the oblique ridge; the nutrient foramina are not situated at the same height in different bones, nor even in the bones of the two sides of the same body; and occasionally the foramen will be double, all of which makes measures taken at this height difficult of comparison and not fully reliable.

The details of the measures cannot be given in an abstract. Advanced platycnemy (index below 60) is very rare in both the whites and the negroes, but is common in the Indians. In average the tibia is somewhat (two or three per cent.) more platycnemic at the height of the nutrient foramen than it is at the middle. The relative position of the external border can be measured. The articular surfaces of the male tibia are larger than those of the female.

The head of the tibia as a whole is larger in the male both antero-posteriorly and laterally. The backward inclination of the head does not vary materially in the whites and the negroes, although in about one-half per cent. in the white bones the inclination backward is plainly augmented. In Mexican Indians, particularly in some tribes, a pronounced backward inclination of the head is common.

The spine is, as a rule, double. Its length is not dependent on the length of the bone, and may differ on the two sides of the same body. The male spine is, on the average, slightly longer.

The weight of the tibia differs greatly; it is much influenced by the age of the person. The weight and displacement of the bone being compared on a series of subjects, the following results in general were obtained: The tibia is heaviest in proportion to its volume between 20 and 40 years of age. Above 40, and sometimes even before, the weight in proportion to the volume of the bone diminishes. This diminution

is due to the beginning senile rarefaction ; it differs very much in different subjects, and is rarely the same on the two sides of the body. The rarefaction is much more regular and at all ages greater in the female. Bones of aged individuals may show as low as one-fourth of the relative weight found in young adults.

The displacement of the tibia may be measured with shot or seeds, by a rough and unsatisfactory calculation from the various measures, or by rapidly immersing the bone in some heavy liquid which is not liable to be rapidly absorbed. The author used glycerine.

There are chemical differences between the bones of young and old persons. The inorganic matter seems to decrease with age.

The tibia is not subject to gross anomalies, but is very much subject to pathological conditions. An interesting, though perhaps not congenital, anomaly found, consisted of a well-defined, rounded, slightly convex, six mm. broad, articular facet on the tip of the malleolus of one tibia.

The causes of the numerous variations of the tibia are apparently very multiple. Some indications point to the fact that they are partly due to hereditary influences and partly to acquisition. The effects of muscular action on the shape and size of the bones will require much additional investigation.

The details as to the pathological conditions found will also be given later.

DR. LAMB agreed with the author in at least two points; first, that platycnemism is common in the bones of Indians in the Army Medical Museum and not in those of negroes; and, second, that for the reasons given by the author, the tibial index is more reliably measured below the opening of the nutrient foramen and oblique ridge.

AN X-RAY STUDY OF THE NORMAL MOVEMENTS OF THE CARPAL BONES AND WRIST.

BY EUGENE R. CORSON, B. S., M. D., SAVANNAH, GEORGIA.

From an X-ray study of Colles's fracture I was led to study the normal movements of the wrist, and the results I have obtained seem to me worthy of publication. On the first thought it would seem that the mechanism of the wrist is a simple matter, and very easily learned, and that our text-books on anatomy must give the final word on the subject. On the contrary, I found that the text-books were quite at variance on many important points, and that even such an important point as the relative position of the bones of the radio-carpal joint showed a difference that was startling. I introduce here two illustrations representing sections of the radio-carpal, mid-carpal, and carpo-metacarpal articulations: one is the well-known figure from Gray (Fig. 1), and the other (Fig. 2) is from Testut's beautiful Anatomy.* A glance will show how different they are. In the figure from Gray† the scaphoid and semilunar articulate with the radius, while in Testut's the semilunar is found to articulate with the radius and the ulna indirectly through the triangular fibro-cartilage. This the X-ray proves to be the proper relationship of the parts. Gray's figure is also found to be at fault in its representation of the synovial sacs of the carpus, the os magnum and trapezoid, for example, being represented as entirely surrounded by synovial membrane. In the new editions of Gray we should seek to replace rather than to add, for it is getting to be too large as a text-book, and this figure should give way to Testut's. Compare this figure with the outline tracing of the carpus with the hand straight with the forearm and the similarity is quite perfect. In 1891 Professor Shepherd,‡ in the *Journal of Anatomy and Physiology* showed that the semi-lunar always articulates with the ulna, not immediately, of course, but by means of the interposed cartilage

* *Traité d' Anatomie Humaine*, par. L. Testut, Paris, 1896.

† *Anatomy, Descriptive and Surgical*, by Henry Gray, F. R. S., Philadelphia and New York, 1896.

‡ A Note on the Radio-carpal Articulation, by Francis J. Shepherd, M. D., Professor of Anatomy, McGill University, *Montreal Journal of Anatomy and Physiology*, 1891, Vol. XXV, p. 349.

or meniscus. I find it wrongly figured in Macalister¹, Quain², Gegenbauer³, Henle⁴, McClellan⁵, and even in the recent excellent work of Toldt⁶, although he also gives a very correct figure of the parts. This shows, I think, that in the complete relaxation of the ligaments in the cadaver we lose the exact relationship existing during life and thus err in our representations. As soon as the ligaments at the wrist are weakened or relaxed the hand tends to fall to the radial side, as shown by the deformity in Colles's fracture, and this undoubtedly explains why so many figures show the semi-lunar articulating entirely with the radius. And before I get to the wrist movements proper, a word as to the movement of the lower end of the ulna, about which there has been a difference of opinion and much discussion. Professor Heiberg,* of Christiana, in a paper of some length, contended that the ulna underwent a certain amount of rotation with the rotation of the radius in pronation and supination. This view was combated by Professor Dwight,† of Harvard, in a forcible paper in the *Journal of Anatomy and Physiology*, who denied any ulnar rotation, but described a lateral movement and a certain amount of circumduction. Professor Heiberg afterwards admitted that he really meant circumduction, and thus described the movement: "The lower portion of the ulna, from the great sigmoid cavity to the head of the bone, described the surface of a larger cone, and the olecranon that of a smaller one." Dr. Cathcart,‡ of Edinburgh, also admits this movement of circumduction "sweeping round in the reverse direction to that taken by the lower end of the radius." He further contended that in pronation and supination of the

¹ A Text Book of Human Anatomy. By Alexander Macalister, London, 1889.

² Quain, 1892.

³ Lehrbuch der Anatomie des Menschen, Leipzig, 1892.

⁴ Handbuch der Systematischen Anatomie des Menschen, von J. Henle, 1871.

⁵ Regional Anatomy in its Relation to Medicine and Surgery. By Geo. McClellan, M. D., Philadelphia, 1891.

⁶ Anatomischer Atlas für Studierende und Ärzte, Herausgegeben von Dr. Carl Toldt, Wien, 1896.

* The movement of the Ulna in Rotation of the Forearm. By Jacob Heiberg. *Journal of Anatomy and Physiology*, 1891, p. 237.

† The movement of the Ulna in Rotation of the Forearm. By Thomas Dwight, M. D. *Journal of Anatomy and Physiology*, 1891, p. 186.

‡ On the Movements of the Ulna in Pronation and Supination. By C. W. Cathcart, M. B., F. R. C. S., Edinburgh. *Journal of Anatomy and Physiology*, 1891, p. 351.

hand and forearm the lateral movement of the ulna takes place chiefly at the shoulder joint. This latter view I am not prepared to admit. What have we been able to make out by the X-ray? In comparing the relative positions of the ulna and radius in the outline tracings in adduction and abduction with the hand prone there will be found to be, so far as the X-ray shadow is concerned, no difference; they correspond closely and remarkably. But comparing the relative positions of these two bones in the outline tracings of the profile of the wrist in flexion and extension there is found to be a lateral movement amounting to at least one centimeter. Even admitting possible sources of error in failing to get the wrist always in the same position in each case, a comparison of a number of these tracings of different hands has always shown me the same lateral movement, the styloid process always showing the same relative position in each case. It would seem reasonable enough that the radio-ulnar ligaments, anterior and posterior, would not permit a separation of these two bones in any lateral movement but would permit a certain amount of lateral movement antero-posteriorly. At any rate, the fact stands as shown by the X-ray. While a careful study of pronation and supination by the fluoroscope is a difficult and complicated one, and for me quite impossible so far as showing circumduction, it does at least show that there is no rotation of the ulna. Our guide here is the ulnar styloid process, easily seen from the dorsal side, and with great difficulty, if at all faintly, from the palmar. This is explained by the fact that the ulnar styloid process is nearer the dorsal surface, and, therefore, nearer the fluoroscopic screen. In all the movements at the wrist this relative position is maintained; no matter what the movement of the forearm or hand, the styloid process is visible from the dorsal or extensor surface, and quite invisible from the palmar or flexor surface. Experiments on the cadaver have demonstrated this movement of circumduction beyond question in my mind. As to its cause, however, I am not so certain. As we have seen from our tracings, considerable lateral movement takes place antero-posteriorly in flexion and extension, apparently due to the pull of the adjacent ligaments and tissues in the movements of extension and flexion. Does not the movement of circumduction find its natural explanation from the same cause?

If one will review the literature on the mechanism of the wrist joint and the parts played by the radio-carpal and mid-carpal articulations in the different movements of the hand, a diversity of opinion will be found on many points. Some ignore the important questions in the case, while others attempt a most elaborate description of the movements of the individual bones, a description based necessarily on a study of these movements on the cadaver; it was, of course, the only method available. The many differences of opinion show how unreliable it is to study these movements on the cadaver with all the ligaments relaxed and the muscles inoperative. The observer is very apt to move the bones to suit his own ideas in the matter, and to reason from facets and the direction of ligamentous fibers may carry him in every direction but the right one. Facets may have but little more significance than the facets on a lot of gall stones. Such a good anatomist as Humphry was led to write: "The alternating concavo-convex facets on the two rows are so adapted to one another as to prevent all movements besides flexion and extension" (quoted by Bryce). A glance through the fluoroscope would have convinced him to the contrary. Many forget that joint movements depend as much upon the muscular possibilities of the muscles controlling the joints as upon the bone surfaces and bone relationships with their ligaments. **There is always a beautiful correlation between the two; through practice or congenital peculiarities some may over develop individual muscles to play upon joints of abnormally relaxed ligaments and produce a marvelous range of movements, but it is not natural. There is not a movement of the hand that cannot be increased by an outside force, but such movements are not natural, spontaneous movements, and are therefore not normal.**

For some time I have been convinced that the X-ray could add much to our knowledge of the movements of the wrist, and that this joint was a most favorable one for such a study. I have devoted no little time and thought to the subject, have studied the different movements as carefully as I could through the fluoroscope, and have taken many radiographs of the hand in every possible position. To get comparable results I have been careful to keep the conditions as similar as possible—for example, the time of exposure and the distance of the tube from the plate, and the placing of the part to be examined as near the line of greatest X-ray intensity as possible. I have

been careful to have the plane of the platinum reflector parallel with the plane of the surface examined, so that the rays could strike the plate perpendicularly, or as nearly so as possible.

I learned that I could study and reproduce the findings of the negative best by first tracing the outlines on the negative by a fine pencil and then retracing them on tracing cloth. It would have been impossible otherwise to study the movements of flexion and extension from profiles of the wrist, and, so far as I know, this has not been attempted before. This outline tracing, moreover, carries its lesson so much more clearly. It is diagrammatic, and yet true to the original, with the non-essential parts wiped out. While the study of the movements of abduction and adduction from radiographs of one thickness of bone is comparatively easy, and may be accepted as practically mathematical, when we attempt the same method in profile where two or more thicknesses of bone producing composite shadows have to be examined, the difficulties are greatly increased. And yet, even with these difficulties, much, I think, can be learned to solve the problem before us. Granting that my axes and angles are not perfectly correct, I believe they are near enough so to show us the parts played by the two rows of carpal bones in these movements, and that a certain amount of definite knowledge can be obtained from them. Certainly in a large number of negatives traced I have found a very close correspondence in these tracings, and this has naturally increased my confidence in the method employed. With the fluoroscope and with radiographs taken antero-posteriorly or dorso-palmar we can study the movements of the bones individually as well as by rows, while taken in profile we are limited largely to the rows as rows. The pisiform by its position does offer us an opportunity of studying its movements in profile, and the scaphoid to some extent too, but the other bones are lost in the composite shadow, with the exception of the trapezium and trapezoid, which stand out with the thumb. I believe we can thus learn more of the intimate movements of the wrist than by any other method, and I shall attempt to indicate only what seems to be absolutely demonstrated.

These three radiographs of the hand prone were taken under conditions as similar as it was possible to get them. The hand was bound tight to the plate with a roller bandage, the Crookes tube $10\frac{1}{2}$ inches from the plate, the platinum

reflector parallel with the plate and directly over the middle of the carpus. The exposure was four minutes. These radiographs correspond very closely. In the radiographs taken from the dorsum of the hand—that is, with the dorsum next the plate—the carpal bones came out somewhat more distinctly from being nearer the plate, but this distinctness really added nothing to the correctness of the tracing, and the hand was more strained in assuming the different positions. As I wished to avoid as much strain as possible, and especially any distortion, I have held to the prone position. We shall take first the tracing of the hand straight with the forearm represented in Fig. 3, to get our normal bearings, and the relative positions of the carpal bones with the radius and ulna for the two lateral movements of adduction and abduction. It will first be noted that the long axes of the radius and the os magnum correspond, and that this line passes between the semilunar and the scaphoid; note the position of the pisiform and the length and direction of the scaphoid, and the length of the arc formed by the first row; note that the ulnar end of the semilunar bridges the radio-ulnar articulation and projects $5\frac{1}{2}$ mm. beyond the inner or ulnar edge of the radius; note that the long axis of the os magnum and the middle metacarpal form an angle of 7° . Now note the relations of the parts with the hand in all possible spontaneous abduction. It will be seen that the semilunar shows almost no lateral movement, but has rotated on its antero-posterior axis, and is pressed close up against the articular surface of the radius. The lateral variation does not exceed 1 mm. The scaphoid shows considerable change; it is greatly foreshortened, due undoubtedly to a “screw” movement on an axis diagonal to its antero-posterior and longitudinal axes, the direction of this movement being towards extension. The pressure brought to bear is from the rotation of the os magnum; the foreshortening is about 2 mm. in comparison with the hand straight, and is the best evidence the X-ray gives of the obliquity in the transverse axes of the first and second rows; the whole movement brings it closer to the radius. The pisiform has changed its position and moved with the second row in its rotation. As the sesamoid bone of the flexor carpi ulnaris whose tendon is prolonged to the unciform and the base of the fifth metacarpal, it must follow these bones. In comparing the position of the pisiform with the hand in marked adduction the flexor

carpi ulnaris must be the great adductor of the hand, especially as flexion and adduction are supplementary. Looking at the first row of bones as a whole, it will be noted that the arc has shortened at least 2 mm. from the first position, caused almost entirely by the lateral movement and rotation of the second row through an angle of 19° . Note that the bones of the first row and of the second row maintain well their relative positions to their respective rows; the trapezium and the trapezoid, holding well together, glide unobstructed over the scaphoid; note, too, that the middle metacarpal has adjusted its axis to that of the os magnum and has thus moved through an angle of 7° . As the os magnum has been pressed up close against the scaphoid, so the unciform follows close on its heels. This movement of the metacarpal through an angle of 7° is about the limit of movement in all the metacarpals, the thumb, of course, excepted, having really no metacarpal. The same principle applies to the movements of the metacarpal row upon the second carpal row that this row does upon the first, namely, so long as the movement is free in the proximal row the distal row moves with it, but when the proximal row comes to a stand the distal row has a certain range of continued movement. This angle of 7° represents about the greatest movement attainable in the metacarpal row through spontaneous movement of the hand; of course by force this can be somewhat increased, but not much.

Now study the hand in marked adduction and note the changes. The first row has rotated through an angle of 16° , and the ulnar edge of the semilunar has passed just within the ulnar edge of the radius. The first row has rotated through an angle of 16° , and the second row has rotated through an equal angle of 16° , the entire adduction equaling 32° . The scaphoid in the rotation has been stretched out to its full length, so to speak; it is 6 mm. longer than in the straight position of the hand and 8 mm. longer than with the hand in abduction. Its long axis is about parallel with that of the radius. Note the position of the pisiform, showing how it has followed the traction of the tendon of the flexor carpi ulnaris. The pisiform is not a carpal bone properly speaking, and it shows here its independent movement. Note how close it comes to the ulna; in flexible hands I have seen the shadows touch. The unciform in pressing down upon the pyramidal has been grasped by this

latter bone and undergone a certain amount of rotation. In studying these movements through the fluoroscope it is easily seen how the second row supplements the first in the two movements of abduction and adduction. So long as the first row is free to move the second takes no part in the movement, but just so soon as the first row has reached its limit the second comes into play and completes the movement. It is in abduction that the second row is most active, for, owing to the strong internal lateral ligament, the first row has no chance to rotate, and is at once held tight, and the second row must do practically all the abduction, equal in this case to 19° , three degrees more than in the movement of adduction, though this latter movement, owing to the greater freedom of the first row, is 13° more for the entire hand.

No observations on the dead hand can possibly equal in accuracy these X-ray studies on the living; the many differences of opinion among anatomists in regard to these movements show the many sources of error from relaxed ligaments and inoperative muscles. I shall presently allude to some of these differences. To the credit of the French School, be it said that they have been more accurate, for they have studied and figured the parts from frozen sections. Had Testut had the advantages of the X-ray he could not have given us a more accurate figure than the one I have introduced in comparison with the very faulty figure of Gray.

I will state that I have taken a number of these radiographs from several hands, and they correspond closely. Naturally different hands show difference in the extent of these movements, and by force they can all be exaggerated, but they then become abnormal; but I contend that the parts played by the several bones and articulations remain the same and their relations unaltered.

And now let us study the movements of flexion and extension, looking at the hand in profile. While the study of the radiographs through one thickness of bone was easy enough, the composite shadows obtained from the profile view increased the difficulties greatly, and the prints from the untouched negatives seemed to offer little hope of obtaining any very accurate results; and I found, further, that I could not get much from the fluoroscope. After a careful study of a number of negatives, I discovered that by carefully tracing the outlines with a fine, soft pencil, the negatives being placed on a white

surface at an angle of 45° before a shaded Welsbach lamp, I got outlines that corresponded wonderfully well, so closely, in fact, that I feel I can reproduce them with much assurance of their accuracy. The composite shadow of the first row was almost an enlarged figure of the semilunar bone, and as this bone is represented in the profile figures of the wrist as the typical bone of the first row, it answered my purpose wonderfully well. Though the second row gave me a more complicated composite shadow than the first, the part played in it by the os magnum, the typical bone of the second row, is fairly well made out. In fact, it is a fairly good representation of the os magnum. Though I cannot put as much confidence in the axes and angles drawn as in the antero-posterior view, I believe they are accurate enough to show us the real parts played by the two rows of carpal bones in the movements of flexion and extension. I found, further, that the best profile view was obtained when the ulnar side of the wrist rested upon the plate. The same precautions were taken as with the previous radiographs; the tube was 15 inches from the plate, the platinum reflector parallel with the plate and directly over the center of the carpus. The hand and forearm were bound firmly down by a roller bandage to bring the bones as close to the plate as possible, and to prevent the slightest movement. The exposure was eight minutes. On account of the greater difficulties in obtaining accurate tracings, and the greater liability to error, I have introduced the findings in two hands to show how well they correspond. The smaller one (case No. 1) is a man's hand, and a very flexible one. I have also introduced a woman's hand, where the extension was above the average. And first look at the tracing with the hand in a direct line with the forearm. Note that the composite shadow of the first row appears as an enlarged semilunar bone, the typical bone of the first row, and that the composite shadow of the second row is a fair representation of the os magnum, the typical bone of the second row. The trapezium and trapezoid come out with the thumb, the shadow much enlarged from being some distance from the plate; just back of them is the shadow of the pisiform. It will be seen that the longitudinal axes of the radius and the first row fairly correspond; there is evidently a slight deviation towards extension, that is, a movement towards the dorsum of the hand. While we know that the transverse axes of the radio-ulnar

articulation and the first carpal row do not correspond, and show more their obliquity when viewed *en face*, when viewed in profile they appear to correspond, and may be so regarded in studying the movements of flexion and extension apart from any lateral or rotary movement. Note again that according to our lines the second row forms an angle towards extension of about 15° with the first row. I find that anatomists figure this angle differently. Braune, for example, in the figure in Gray, p. 356, makes it as great as 30° , while Toldt, in his recent work, makes it only about 10° —a great discrepancy. Thirty degrees, I think, is entirely too great an angle, while Toldt may somewhat underestimate it. Thus my figure seems to be a fair compromise, and I believe it is not far from the truth. At any rate, it is a good working angle to start from. In case No. 2, the woman's hand, this angle comes out 12° . It certainly must vary somewhat in different hands. As this angle is towards extension, it must be added to the angle made in flexion by the second row with the axis of the radius, and subtracted from the angle made by this row in extension with the axis of the radius, to get the real amount of flexion and extension in the second row.

Now look at the tracing of the same hand in flexion (Fig. 7). The prominent part played by the first row is very apparent; it has moved through an angle of 60° , and while the second row forms an angle of 70° with the axis of the radius, the work has been done by the first row, and the second row has really moved through an angle of 10° plus the angle of 15° which it had to overcome in the beginning, making in all but 25° of flexion for the second row. We have seen how the first row is prominent in adduction, and this tallies well with the part it plays in flexion, the two movements being supplementary.

Turning now to the profile tracing in extension (Fig. 8), we find that the first row has moved through an angle of 20° with the axis of the radius while the second row forms an angle of 58° with this axis. As this second row had a start of 15° on the first row, the second row has really moved through an angle of $58^\circ - 20^\circ - 15^\circ = 23^\circ$. Thus the second row has moved through a somewhat greater angle than the first, and this tallies with the figures given in abduction, the supplementary movement of extension. The power of extension is not great in this hand, else it would show better

the major part played by the second joint in this movement; the more the extension, the greater the role played by the second row. It was found in the same hand that the second row was the chief factor, practically the only one, in abduction, the angle being 19° .

And now for comparison, compare the tracings in case No. 2, a woman's hand. With the hand in direct line with the forearm, the angle between the two rows is found to be about 12° . In flexion (Fig. 10), the first row has moved through an angle of 46° while the second row forms an angle of 70° with the axis of the radius. As the second row had to overcome 12° before starting even with the first row, and as the angle formed by the two rows is 24° , the second row has really moved through an angle of 36° . This shows how the second row supplements the first. In this case the first row shows a rather poor movement in flexion in comparison with case No. 1, and the second row comes to the rescue and produces a final flexion equal to the first case.

In extension in case No. 2 (Fig. 2), the first row shows an angle of 15° with the axis of the radius while the second row forms an angle of 53° with the radius. Here again the second row has only moved through an angle of $53^{\circ} - (15^{\circ} + 12^{\circ}) = 26^{\circ}$ being thus the chief factor in extension. In the same hand in somewhat forced extension the first row remains the same while the second row adds but two more degrees to the extension. In the same hand in somewhat forced flexion the first row forms the same angle of 46° with the radius as in the ordinary flexion, while the second row forms an angle of 78° with the radius, a gain of 8° over the second row in the first flexion. As the difference between the two rows is 32° the second row has moved through an angle of 44° .

I give finally the tracing of a wrist in a woman's hand capable of great extension. The first row forms an angle of 34° with the axis of the radius, and the second row has therefore moved through an angle of 86° less 34° , less the normal angle of deviation of the second row over the first, not ascertained, but probably between 12° and 15° . Notice in the tracing how large the composite shadow of the second row is. This is caused by the radial side of the row overarched the ulnar side in the marked extension and producing from its distance from the plate a greatly enlarged shadow.

To recapitulate briefly, the X-ray findings show that com-

plete adduction is about equally divided between the two rows, and that abduction is almost entirely accomplished by the second row,* the movement on the whole being much less than in adduction; that in complete flexion most of the movement is accomplished by the first row, while in complete extension the second row performs most of the movement.

If you will observe the movements of your own hand in passing through the different phases of circumduction, you will see that flexion aids adduction, and vice versa, and extension abduction, and that these movements are supplementary. Before I studied these movements by the X-ray, I believed that almost all the movement was accomplished by the radio-carpal joint, and that if, for example, all the carpal bones were ankylosed and moved as one bone, there would still be a fair wrist function. These X-ray findings have dispelled that idea, and we can now see how limited the movements of a hand would be were the carpal bones ankylosed into one bone.

But the study of the movements through the fluoroscope as well as the findings of the radiographs show that the carpal bones act as two rows and not as a cluster, and if the three bones of the first row and the four bones of the second row were ankylosed into two bones there would still be very fair movement at the wrist. That the carpal bones act as two rows rather than as individual bones in a cluster is also shown by the arrangement of the interosseous carpal ligaments. The bones of the first row are united together and the bones of the second row likewise, while the mid-carpal joint is free from these ligaments. Sometimes there is a small interosseous ligament between the os magnum and the scaphoid as well as between the trapezium and trapezoid. The usual arrangement is as shown in the little figure I introduce from Sappey (Fig. 15), which is in every way very correct. Though there is usually no interosseous ligaments between the trapezium and trapezoid these bones keep well together in the movement of the second row, and even in the movements of the thumb the fluoroscope fails to show any appreciable individual movement in the trapezium.

If we are to profit by these revelations of the X-ray in our attempt to get a clear idea of the entire mechanism of the wrist joint we must turn to our anatomy and note the follow-

* Henle stated that adduction was confined to the radio-carpal joint, and abduction to the mid-carpal, which was not so very far from the truth.

ing points: 1. That the carpal bones in their cluster form a sort of arch with the convexity towards the dorsal and the concavity towards the palmar surface. 2. That the transverse axes of the first and second rows, which give to these rows their antero-posterior movements of flexion and extension, are neither parallel with each other, nor with the transverse axis of the radio-ulnar articulating surface; on the contrary they form quite an angle with each other. I introduce here a figure copied from Toldt, but modified, as he wrongly represents the relative position of the first row to the radio-ulnar articulation. This gives, I think, a fairly accurate representation of the two transverse axes of the two rows. These axes are thus described by Beaunis et Bouchard:

"The axes of these articulations are both perpendicular to the axis of the forearm, but they are not parallel; they cross, and their point of crossing is almost exactly the head of the os magnum, veritable center of all the movements of the carpus. The axis of the radio-carpal joint, oblique from without inwards and from behind forwards, may be represented by a line passing from the styloid process of the radius to the pisiform. It is thus situated entirely below the articular interline. The axis of the mid-carpal joint is oblique in an inverse sense, that is to say, from within outwards, and from behind forwards, and passes from the point of the apophysis of the scaphoid to the back of the pyramidal; it cuts twice the articular interline. From this obliquity of the axes it is easily seen that, first, for the radio-carpal joint, the hand is inclined in flexion from the radial side, in extension from the ulnar, and second, for the mid-carpal joint, the hand in flexion is inclined from the ulnar side, in extension from the radial." (Free translation.)*

Now it is this obliquity of the transverse axis of the first row and the large angle it makes with the transverse axis of the radio-ulnar articulation which is the chief point for us to consider in our study of the movements of the hand on the forearm. Moreover, it is very apparent if we will flex the hand naturally and notice the slant it takes in that movement and the tendency of the hand toward adduction; again, if we continue in the movement of circumduction from flexion and adduction to extension and abduction and back again,

* *Nouveaux Elements d'Anatomie Descriptive et d'Embryologie*, par H. Beaunis et Bouchard, Paris, 1894, p. 169.

that adduction and flexion go together and are supplementary, so to speak, and that abduction and extension hold the same relationship. This tallies with our X-ray findings. The hand, in fact, executes its movements always at an angle with the forearm, so that there is never a pure flexion, extension, adduction or abduction, but always a combination of one with the other. These movements in their absoluteness could only take place if the transverse and antero-posterior axes of the forearm and carpal rows corresponded, which they do not; and yet Beaunis et Bouchard*, fully realizing and describing these obliquities, try to prove from these very obliquities that the hand accomplishes these four movements in all their purity. By a great effort, if one will try the experiment, he may partially succeed in paralleling the transverse axes of the radio-ulnar articulation and the first carpal row, and approximate these pure movements, but he is conscious of a great strain and effort, and he will find it only an approximation. And he will further find that all movements become very limited and the radio-carpal joint is as though it were locked. As to the obliquity of the mid-carpal joint, it cannot be seen, nor is one aware of it on the living hand, but we have decided evidences of it from the X-ray in the change of curvature of the first row, the rotation of the scaphoid and pyramidal, the former foreshortening in abduction and stretching out in adduction from the oblique pressure brought to bear upon it from the second row in its oblique lateral movement. And with a little thought is it not apparent that the wonderful and beautiful flexibility of the human hand is largely due to this very obliquity in the two carpal rows? That the elliptical circumduction of the hand, with the long axis in the direction of flexion and extension, is only possible, considering the anatomical make-up of the hand, from this obliquity. And further, it is evident that the strain upon the individual carpal bones in the different movements is greatly reduced by this arrangement. The "screw" movements of the scaphoid and pyramidal and os magnum all depend upon this obliquity, as well as the apparent rotation of the os magnum on its long axis. And before closing this paper I should like to refer to certain authorities and show how they differ, and how the X-ray helps to explain and clear up these differences. It will enable me, too, to explain more fully certain points.

* *Loc. cit.*

In the *Journal of Anatomy and Physiology* for October, 1896, there is a paper by Mr. T. H. Bryce entitled, "On certain Points in the Anatomy and Mechanism of the Wrist-joint Reviewed in the Light of a Series of Roentgen Ray Photographs of the Living Hand." Mr. Bryce has only employed the X-ray in radiographs of the carpus antero-posteriorly, with the hand straight, and in abduction and adduction, and has made no use of the fluoroscope; at least he does not mention it. I can agree with him on several points, namely, the greater degree of laxity of the articulations during life than is generally supposed; that the movement of extension of the first row is less than the flexion; and that the os magnum has a greater range antero-posteriorly than laterally. I differ from him in his explanation of the impossibility of lateral movement in complete flexion. He ascribes it to the locking of the trapezium and trapezoid on the scaphoid, and the anterior border of the unciform on that of the pyramidal. I should ascribe it to the greater tension of the posterior ligament, which practically holds the entire carpus as in a splint, and to the lack of further muscular power, the extensors being stretched and the flexors relaxed, they have no further action, and all lateral movement is dependent upon them. As I have attempted to show, extension favors abduction, and with the hand in extension, outside force can increase slightly the abduction. The same explanation holds here as in the previous case, namely, the general ligamentous tension and inoperative muscles. But the consideration of these unnatural conditions, for nature never intended lateral movements in complete flexion or extension, aids us but little in our studies of the normal joint functions.

I must differ from him as to the parts played by the extensor and flexor muscles of the wrist. He writes: "The extensor muscles of the wrist, from their relations and attachments, are certainly more efficient than the flexors in producing lateral movements. The flexor carpi radialis, from its oblique position, is much more of a pure flexor than an abductor; while the flexor carpi ulnaris can only have an indirect action on the distal range, and will be effectual chiefly in producing the radial displacement of the proximal range."

I have attempted to show that flexion and adduction are supplementary movements, while abduction and extension are supplementary. As adduction is a more extensive lateral

movement than abduction, the difference between 32° and 19° , the flexor carpi ulnaris and the flexor carpi radialis, especially the former, which, with its leverage on the pisiform and its control of the second row through its piso-metacarpal ligament and its branch to the unciform, make it a strong adductor as well as a flexor, are the two muscles chiefly concerned in adduction. Extension on the contrary, being supplementary to abduction, the *extensores carpi radialis longior et brevior* must be the chief abductors, inserted as they are into the base of the metacarpals of the index and middle fingers. Whatever influence the flexor carpi radialis has in abduction, must be in the beginning of the movement. This, at any rate, is what we should be led to think from our X-ray findings. As in the movements of adduction the two rows share the honor, so we find two muscles operative, the flexor carpi ulnaris which affects chiefly the first row but also the second, and the extensor carpi ulnaris which influences the second row, probably only in the beginning. Abduction being practically limited to the second row, we find no abductor inserted into the first row, but only into the bases of the metacarpals which is practically the second row, with the advantage of some additional leverage. Examine carefully the flexor carpi radialis, and you will find that it is primarily and principally a flexor, and that its power of abduction must be very limited.

I must differ *in toto* from the description of the mechanism of the wrist movements as given by Beaunis et Bouchard. They admit a pure flexion, extension, abduction, and adduction, and they thus try to explain it. After describing the two oblique axes of the two rows, a description which I have already introduced, they state :

"Suppose now that flexion is made simultaneously in the two articulations, the lateral movements, being in a sense opposed in each articulation, are destroyed and we shall have pure flexion ; the same for extension. Suppose, on the contrary, that flexion occurs in the radio-carpal and extension in the mid-carpal, the opposed movements, flexion and extension, are destroyed, and pure radial flexion results ; likewise ulnar flexion takes place by extension of the first row and flexion of the second. This explains why the lateral movements are not possible in extreme flexion or extension, and how, also, flexion and extension are impossible in extreme lateral move-

ments." (Free translation.) This seems to me most remarkable reasoning, and I am not aware that it has ever been questioned. In the first place, they assume what does not exist and cannot exist, *i. e.*, pure flexion, extension, adduction and abduction. In the second place, in their mathematical reasoning they assume that these two oblique axes of the two rows of carpal bones are so even and equal in their bearings that they neutralize each other. It seems to me that a child could see that the axis of the first row is comparatively free, while the axis of the second row is not so. They must have studied the movements of the hand of a manikin, constructed on straight lines and right angles, instead of on the human hand. In their hypothetical reasoning they speak of flexion of the first row and extension of the second, and vice versa. In the metacarpals and phalangeals we may extend the proximal joint and flex the distal, but not vice versa; but when we come to the two carpal rows, this combination becomes impossible, and the X-ray shows this very clearly.

As stated before, the hand in all its movements performs them at an angle to the forearm, and this angle largely depends upon the angle existing between the transverse axis of the radio-ulnar articulation and the transverse axis of the first row of carpal bones. While the transverse axis of the second row does influence the relative positions of bones of the two rows with each other, producing certain "screw" movements and rotations, apparent in the exposed joints of the cadaver as well as by the X-ray, modifying, to a certain extent, the primary movements of the hand, they are not apparent on the living hand. We can, by a strong muscular effort, *approximately* parallel the transverse axes of the radio-ulnar articulation and first row of carpal bones, but we are conscious of a severe strain and find the normal movements practically impossible.

Sappey* states that the bones of the second row execute but slight gliding movements; that the second flexes more on the first row than the first on the forearm; that the second row conduces but slightly to the extension of the hand—all of which statements we have tried to show the X-ray disproves. He should be given the credit, however, of appreciating the lateral movements in the carpal bones.

If we turn to Gray we find again considerable differences.

* *Traité d' Anatomie Descriptive*, par Ph. C. Sappey, Paris, 1876.

Flexion and extension are described as taking place on a transverse axis drawn between the tips of the styloid processes of the radius and ulna. This must be admitted as wrong. The slightest inspection of one's own hand should disprove it. As to the mid-carpal joint, it is stated: "The chief movements permitted in the transverse or mid-carpal joint are flexion and extension, and a slight movement of rotation." We have seen how much more extensive its functions are. "Flexion at this joint is freer than extension." We have found the reverse to hold. Flexion at the radio-carpal joint is so extensive that it leaves little additional movement for the mid-carpal. So in extension, the radio-carpal is limited and the second joint has a showing, and comes to the rescue, and is chief actor in the movement.

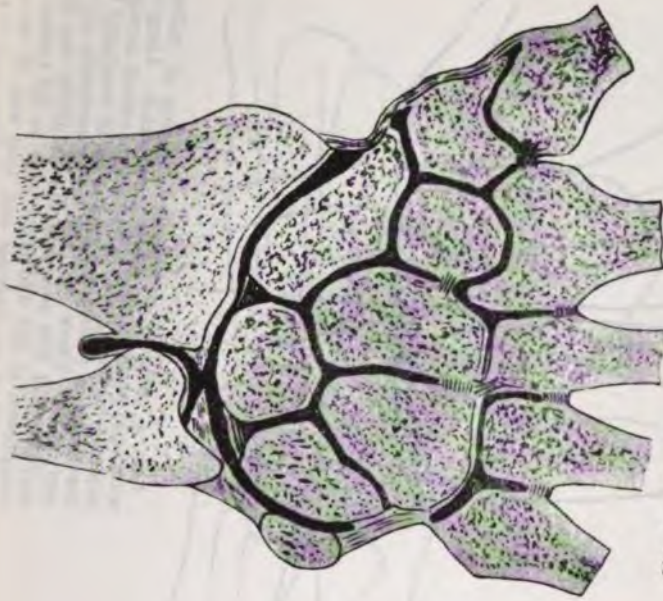


FIG. 2.—Anterior section of the radio-carpal, carpal and carpo-metacarpal articulations (right hand, frozen subject, anterior segment of the section, seen posteriorly). From Testut, Fig. 402, p. 497, *Traité d'Anatomie Humaine*.

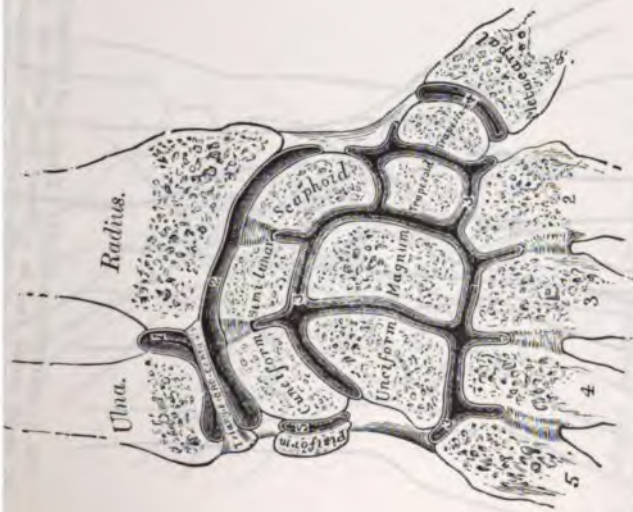


FIG. 251.—Vertical section through the articulations at the wrist, showing the five synovial membranes.

FIG. 1.—From Gray (1896 edition). Fig. 251, p. 360.

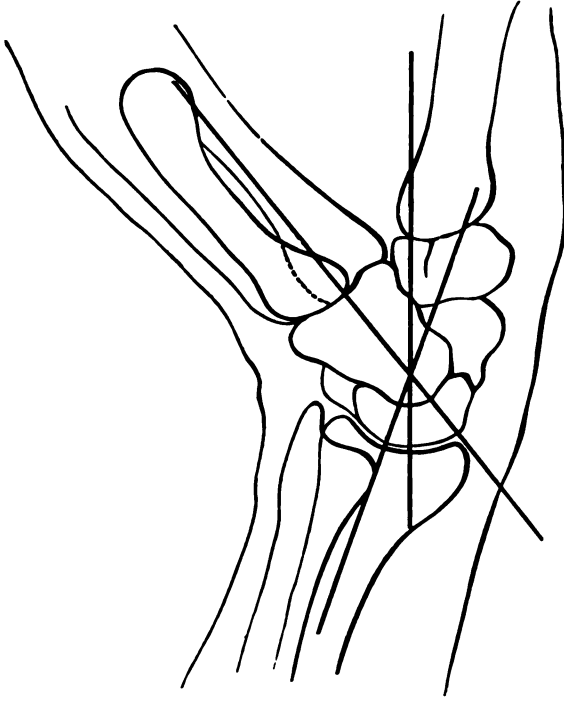


FIG. 8 (reduced one-third).—Case No. 1. Profile tracing of left wrist with hand in extension. First row forms an angle of 20° with axis of radius. Second row forms an angle of 58° with axis of radius. Angle between the axes of the first and second row is 20° . As the second row had a start of 15° on the first row, the second row has really moved through an angle of $58^\circ - 20^\circ - 15^\circ = 23^\circ$.



FIG. 7 (reduced one-third).—Case No. 1. Profile tracing of left wrist in marked flexion. Axis of first row forms an angle of 60° with axis of radius. Axis of second row forms an angle of 70° with axis of radius. Angle between first and second row = 10° ; second row has really moved through an angle of 25° only.

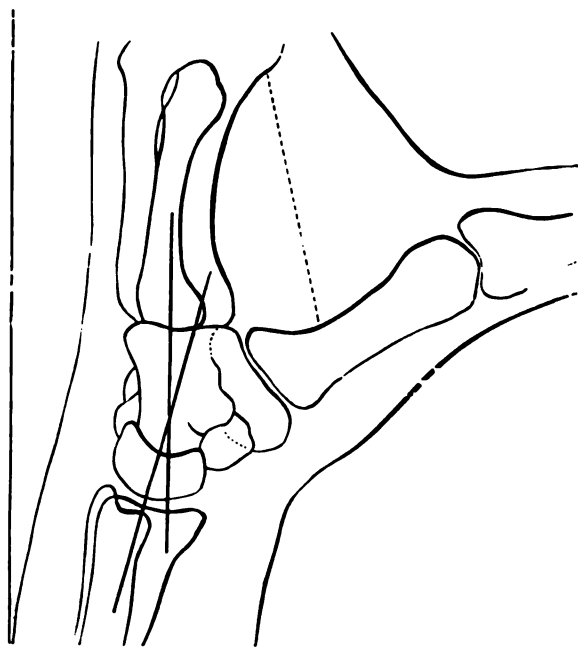


FIG. 9 (reduced one-third).—Case No. 2. Profile tracing of left wrist with hand in direct line with forearm. Axes of forearm (radius) and first row correspond. Axis of second row forms an angle of 12° with the first.

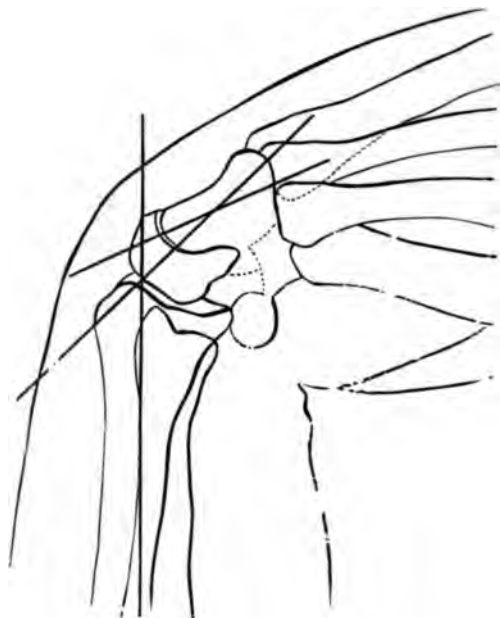


FIG. 10 (reduced one-third).—Case No. 2. Profile tracing of left wrist with hand in flexion. First row forms an angle of 46° with axis of radius. Second row forms an angle of 70° with axis of radius. Difference between first and second row, 24° . The second row has therefore moved through an angle of $24^\circ + 12^\circ = 36^\circ$.

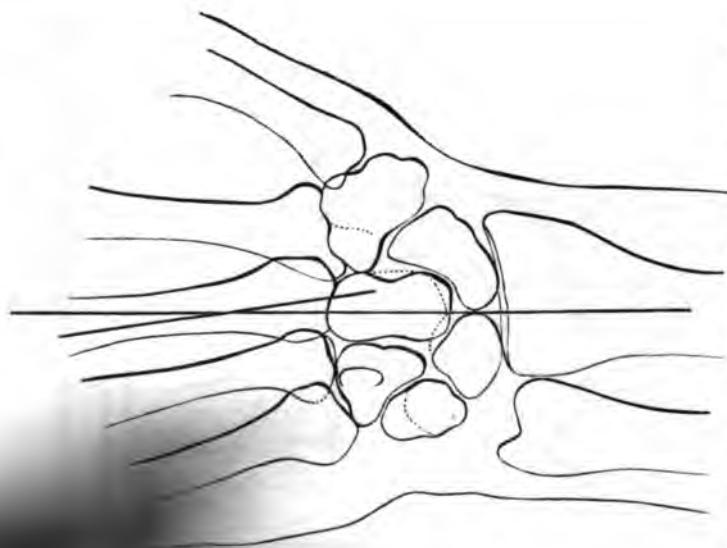


FIG. 3 (reduced one-third).—Tracing of radiograph with the hand prone and in a direct line with the forearm. Longitudinal axis of radius practically corresponds with long axis of os magnum. Inner edge of radius and inner edge of semilunar bone 5½ mm. apart. Long axis of os magnum and middle metacarpal form an angle of 7°.

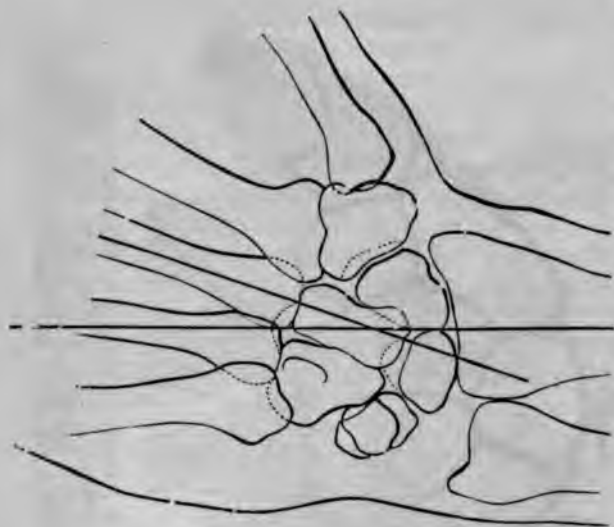


FIG. 4 (reduced one-third).—Tracing of radiograph with hand prone in all possible abduction. Long axis of radius forms an angle of 19° with long axis of os magnum. Inner edge of radius and inner edge of semilunar bone 6 mm. apart. There has thus been practically no lateral movement of first row, and the abduction has been accomplished at the midcarpal joint to the extent of 19°. Long axis of os magnum and long axis of the middle metacarpal correspond so that this latter bone has moved through an angle of 7°.

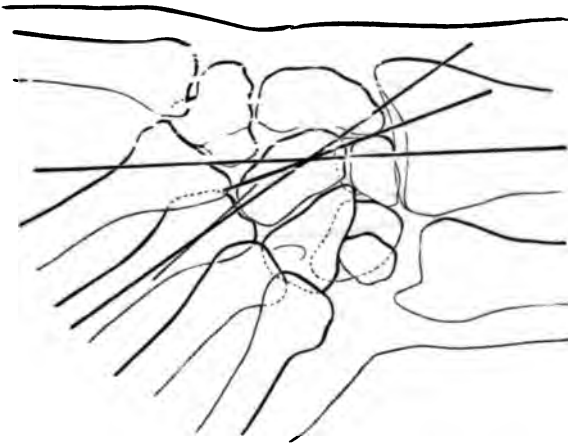


FIG. 5 (reduced one-third).—Tracing of radiograph with the hand prone and in complete adduction. The inner edge of the semilunar bone has rotated just without the inner edge of the radius. The first row of carpal bones has rotated through an angle of 16° and the second row has rotated through an equal angle of 16° , the total deviation being 32° .

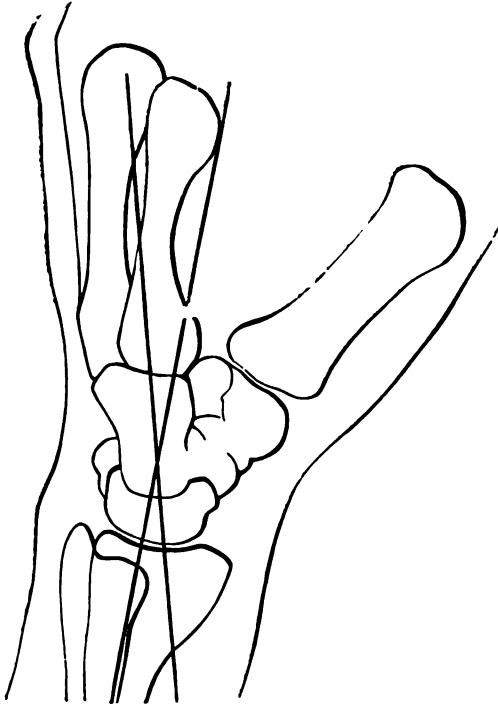


FIG. 6 (reduced one-third) —Case No. 1. Profile tracing of left wrist with hand in direct line with the forearm. The longitudinal axes of radius and first carpal row about coincide; longitudinal axis of second row forms an angle in extension of 15° degrees with the first.

FIG. 8 (reduced one-third).—Case No. 1. Profile tracing of left wrist with hand in extension. First row forms an angle of 20° with axis of radius. Second row forms an angle of 58° with axis of radius. Angle between the axes of the first and second row is 20° . As the second row had a start of 15° on the first row, the second row has really moved through an angle of $58^\circ - 20^\circ - 15^\circ = 23^\circ$.

FIG. 7 (reduced one-third).—Case No. 1. Profile tracing of left wrist in marked flexion. Axis of first row forms an angle of 60° with axis of radius. Axis of second row forms an angle of 70° with axis of radius. Angle between first and second row = 10° ; second row has really moved through an angle of 25° only.

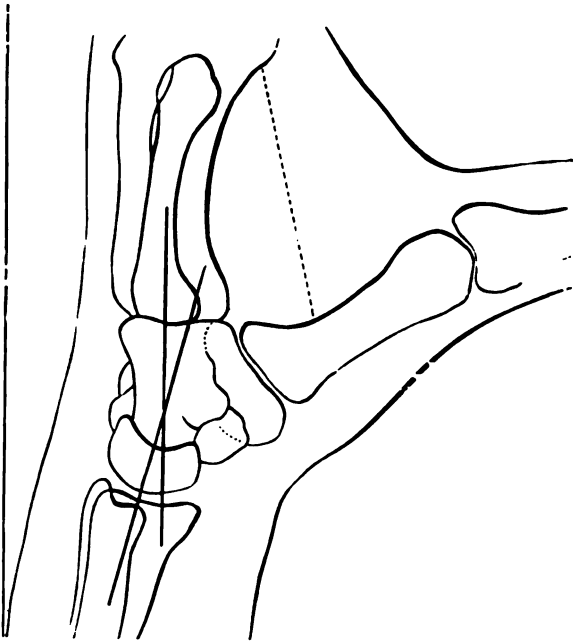


FIG. 9 (reduced one-third).—Case No. 2. Profile tracing of left wrist with hand in direct line with forearm. Axes of forearm (radius) and first row correspond. Axis of second row forms an angle of 12° with the first.



FIG. 10 (reduced one-third).—Case No. 2. Profile tracing of left wrist with hand in flexion. First row forms an angle of 46° with axis of radius. Second row forms an angle of 70° with axis of radius. Difference between first and second row, 24° . The second row has therefore moved through an angle of $24^\circ + 12^\circ = 36^\circ$.



FIG. 11 (reduced one-third).—Case No. 2. Profile tracing of left wrist with the hand in extension. First row forms an angle of 53° with axis of radius. Second row forms an angle of $53^\circ - 12^\circ = 41^\circ$. Angle between first and second row, 15° . Second row has thus moved through an angle of $53^\circ - 15^\circ - 12^\circ = 26^\circ$.



FIG. 12 (reduced one-third).—Case No. 2. Profile tracing of left wrist in forced extension. Axis of first row forms an angle of 15° with axis of radius. Axis of second row forms an angle of 55° with axis of radius. Second row has moved through an angle of $55^\circ - 12^\circ = 43^\circ$, a gain of 2° only over the usual extension.

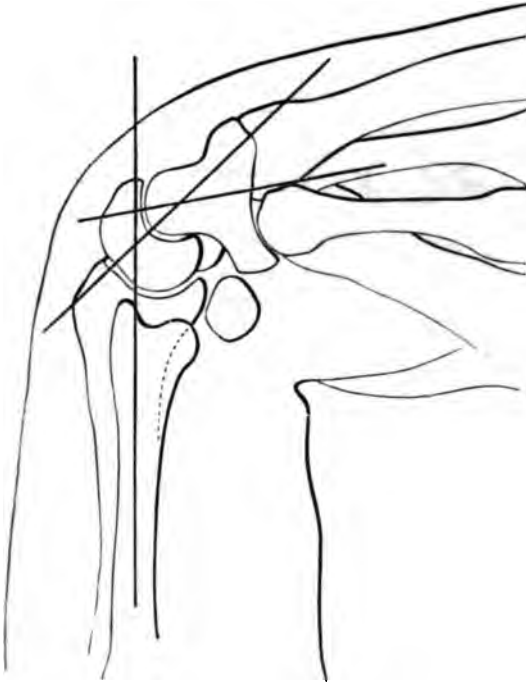


FIG. 13 (reduced one-third).—Case No. 2. Profile tracing of left wrist in forced flexion. Axis of the first row forms an angle of 46° with axis of radius. Axis of second row forms an angle of 78° with axis of radius. Second row has moved through an angle of $78^\circ - 46^\circ + 12^\circ = 44^\circ$.

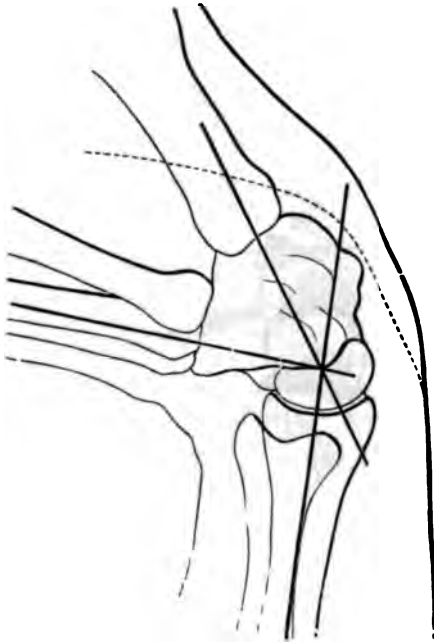


FIG. 14 (reduced one-third).—Case No. 3. Profile tracing of the left wrist with the hand in forced extension. First row forms an angle of 34° with axis of the radius. Second row forms an angle of 86° with axis of radius, and has moved through an angle equal to 86° less 34° , and the normal angle of deviation of the second over the first row, which was not ascertained, probably an angle between 12° and 15° .

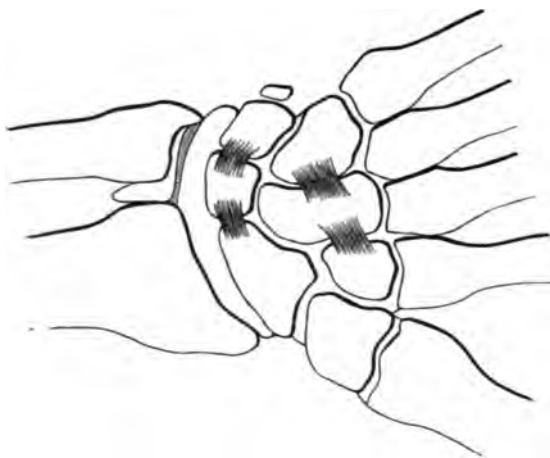


FIG. 15.—From Sappey, *Traité d'Anatomie descriptive*, Vol. 1, p. 669, Fig. 224. Synoviales des articulations du poignet. (Enlarged.)

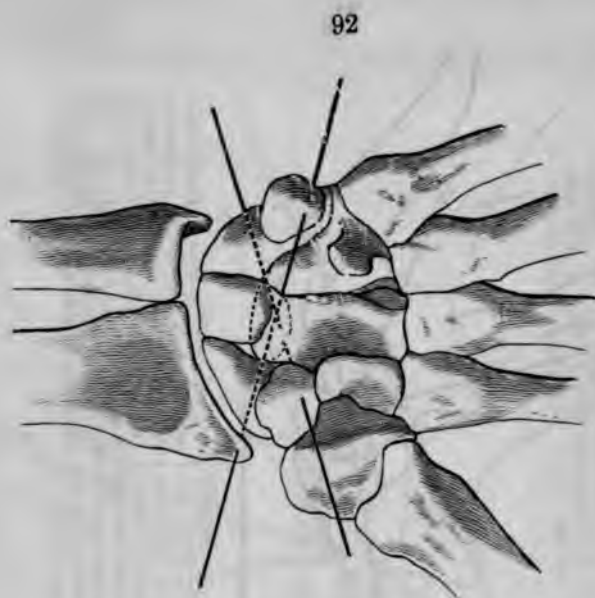


FIG. 16.—Figure modified from Toldt, to show the transverse axes of the two carpal rows.

RELATION OF THE URETERS AND THE GREAT VEINS IN THE CAT.

SIMON HENRY GAGE, ITHACA, N. Y.

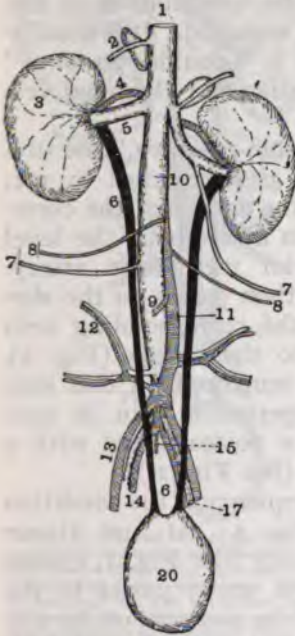


Fig. 1.—Ventral view of the normal arrangement of the blood vessels and of the ureters in an adult female cat; half natural size.

1. Pre-renal or independently arising limb of the postcava (compare Fig. 5). 2. The adrenal or suprarenal capsule and the Vena adreno-lumbalis.* 3. Metanephros, ren or true kidney. 4. Arteria renalis. 5. V. renalis. 6. Ureter. 7. Vena spermatica (ovaril). 8. A. spermatica (ovaril). 9. A. Mesenterica inferior. 10. Post-cardinal segment of the postcava (see Fig. 6). 11. Abdominal aorta. 12. A. et V. ilio-lumbalis.* 13. A. iliaca externa. 14. A. iliaca interna. 15. A. sacra media (caudalis). 17. V. iliaca externa. 20. Urocyct or urinary bladder.

* The vessels here designated "adreno-lumbalis," following Wilder and Gage, '82, pp. 356, 359, is called "phrenico-abdominalis" by Ellenberger and Braun, '91, pp. 409, 410; and by Hochstetter, '93, pp. 585, 594, it is called "lumbalis transversa anterior," in the cat and rabbit. The vessels designated "ilio-lumbalis" in this paper, W. & G., '82, pp. 357, 360, are named simply A. et V. abdominales, in the dog, by Ellenberger and Braun, '91, pp. 412, 449. By Hochstetter they are designated A. et V. lumbalis transversa posterior, '93, pp. 585, 594.

The usual and normal relations of the great arteries and veins, and of the ureters to these vessels in the cat, is shown in Fig. 1. This figure will serve to represent the general normal relationship in man and the higher mammals also. That is, the ureters, extending from the neck of the urocyct are on the ventral side of the iliac vessels. In the abdomen each ureter extends along the side of the postcava and the aorta, finally to enter the kidney of its own side. It is to be noted, however, that while the ureter is on the *ventral* or the *lateral* aspect of all the large vessels of the pelvis and abdomen, it is invariably on the *dorsal* side of the spermatic artery and vein (7 and 8 of all figures). Furthermore, while the spermatic arteries arise from the aorta, the spermatic veins differ in their connections, the right being always joined with the postcava and the left with the left renal.

The deviations from the normal conditions just described are somewhat numerous. Of the twenty cats especially examined for the purposes of this paper, about one-fourth differed more or less markedly from the normal type. These variations are shown by the accompanying figures. Age and sex seemed to have no influence, as variations were found as frequently in kittens as in old cats, and in males as often as in females.

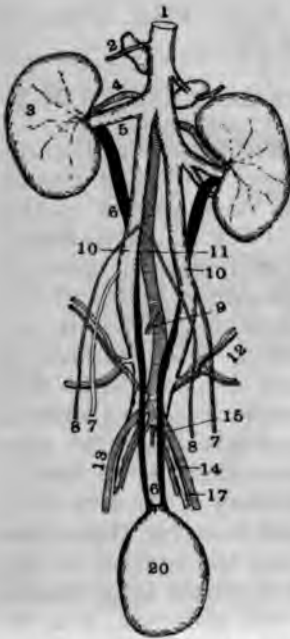


Fig. 2.—Ventral view of the vessels and the ureters of a male cat, half natural size. This shows the so called "double postcava" and the dorsal position of the ureters, and is a typical example of the persistence of both right and left postcardinals beyond the kidneys. The numerals are as in Fig. 1.

an anastomosing branch uniting the spermatic and the ilio-lumbalis (Fig. 3 (22)). This anastomosing branch has not been found in all cases where the right ureter passed along the dorsal side of the postcava; it should be carefully looked for, because it is most probably a rudimentary left postcardinal.

By comparing Figs. 4 and 1 it will be seen that there is a complete reversal in the position of the postcava and the relations of the spermatic veins. This is a case of left postcava instead of right as in the normal type. The union of the left spermatic with the postcava and the right with the right renal is also of exceeding interest and importance as will be seen in the discussion of these anomalies given below.

When the first case of a "double postcava" was investigated in 1883 (Fig. 2 is from that specimen), there seemed to me no

In Fig. 2 is represented the most common and also the most readily detected of the variations from the normal adult standard. It is usually described as a "double postcava" between the iliac and the renal vessels.

With "double postcava," the ureters, in every case observed by me, are between the aorta and the corresponding vein until about the level of the inferior mesenteric artery. Each ureter then passes to the *dorsal* side of the corresponding vein on its way to the kidney (Fig. 2). It is to be remarked in this case that each spermatic vein is connected with a postcava, not with a renal vein. (See Fig. 1.)

Next in frequency is the condition shown in Fig. 3. At first glance this is precisely like Fig. 1, except that the right ureter passes to the dorsal side of the postcava on its way to the kidney instead of laterad of it as in Fig. 1. The left ureter appears normal in position as also the left spermatic vein except that there is

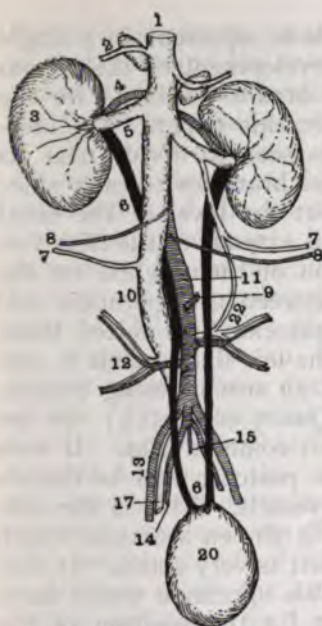


Fig. 3.—Ventral view of the blood vessels and the ureters in a female cat, half natural size. This figure shows a persistent but rudimentary left postcardinal (22) with the ureters on the dorsal side of the postcava and of the rudimentary postcardinal. Otherwise the specimen is normal. Numerals as in Fig. 1.

viz: that from the heart to the kidneys, being a new formation, and the segment from the kidneys to the iliac vessels being a transformed postcardinal.

It will be seen from this brief statement that the part of the great veins involved in the anomalies described in this paper is derived from the postcardinals. In the usual, that is to say in the normal course of events, the postcava between the renal and the iliac vessels is formed from the *right* postcardinal. The corresponding part of the left postcardinal atrophies.

rational explanation for the anomalous position of the ureters. At that time, embryologists followed the teachings of Rathke as to the development of the postcava. According to this view the postcava was thought to be a wholly new formation from the heart to the iliac region. Thanks to the investigations of Hochstetter ('93) and of others during the last few years, it is now known that the postcava has a double origin, one segment,

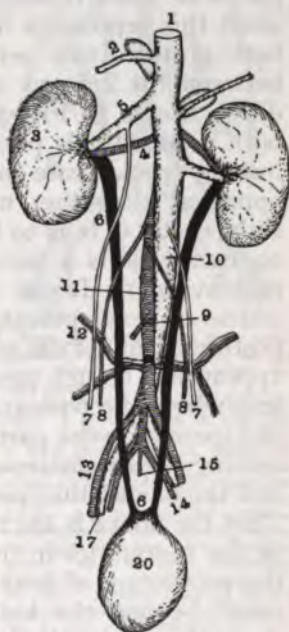


Fig. 4.—Ventral view of the vessels and ureters in a male cat, half natural size. This figure shows the postcava in a reversed position (left postcava). In this case the left instead of the right postcardinal remained as the postrenal segment of the postcava. It is also to be noted that the left spermatic vein joins the postcava while the right spermatic joins the renal. Compare with figure 1.

In Fig. 5 an effort has been made to represent in a single diagram most of the steps in the development of the venous system and the permanent urinary organs necessary for the elucidation of the points involved in this paper. The independently developed postcava (1) is seen to divide near its caudal end and to send one of these branches to each side; that is to the postcardinals at about the level of the renal veins (5). On the right the cardinal extends to the iliac vessels and seems to be a continuation of them, while on the left the cardinal (22) disappears between the spermatic and the iliac vessels, and is therefore represented by dotted lines. The returning venous blood from the left iliac vessels is conveyed to the right side by means of an anastomosing branch, the *Vena iliaca transversa* (16). (Quain '92, p. 545.) In the adult this represents most of the left common iliac. If now both postcardinals persist, then the postcava will be double between the kidneys and the iliac vessels. This is the condition shown in Fig. 2. In Fig. 3 is shown a case in which both postcardinals persist, but the left is very small. In fact but for special care in dissection, this specimen would have appeared altogether normal except for the position of the right ureter. It is to be further noted that the spermatic (7) on each side is a part of the cardinal, not of the definitive postcava (1). It can also be readily seen that in the usual course of development, where the right cardinal becomes the postrenal limb of the adult postcava, the right spermatic would appear as a branch or confluent of the postcava, while on the left, where the postcardinal disappears between the iliac and the spermatic, the part of the postcardinal remaining and receiving the spermatic would be drawn into line with the renal and thus make the spermatic appear as a branch of the renal. That the above is the true explanation of the normal relations of the spermatics in the cat, is shown by the cases where, by the persistence of both postcardinals, there is a "double postcava" beyond the kidneys, as shown in Fig. 2. It is also strengthened by the conditions shown in Fig. 3, where both cardinals persist, but the left is very small. Perhaps the final and strongest proof is furnished by cases in which there is a reversal in the position of the postcava as shown in Fig. 4. Here the right postcardinal disappeared while the left remained the postrenal limb of the postcava. In the iliac of the left side joins the postcava, while

the *right* spermatic joins the renal, as that contains the only persistent remnant of the postcardinal joining the postcava in this region.

The Relative Position of the Ureters and of the Great Veins.—The explanation of the position of the ureters must be sought in the development of the metanephros or true kidney. It is represented by embryologists (Minot, '92; Hertwig, '92) as originating in an evagination of the mesonephric duct near the cloaca. From the point of evagination it extends cephalad along the ventral aspect of the iliac vessels, and between the aorta and the corresponding cardinal vein (Fig. 5). In the neighborhood of the inferior mesenteric artery the kidney moves laterad and passes on the dorsal side of the cardinal. This must necessarily place the ureter on the dorsal side of the vein. Such conditions are shown in Fig. 2 (3). In the normal course of development, however, as shown by Hochstetter ('93), the ureter does not remain on the dorsal side of the postcardinal, but grows through it, so to speak. It first makes a notch in the vein, then the vessel repairs itself on the dorsal side, leaving the ureter for the time in a ring. Such a ring sometimes persists in the adult cat as shown in Fig. 6. It may be the normal condition on both sides in some animals. (Hochstetter, '93. His plate xxiii, Fig. 24, of the hedgehog would indicate a normal double postcava with the ureter in a ring in each.)

Usually, however, the ureter

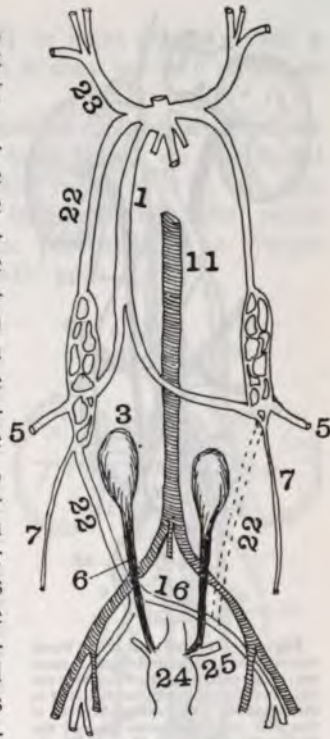


Fig. 5.—Diagram to show schematically the development of the great veins and the permanent urinary apparatus.

1. Pre-renal segment of the post-cava. 3. Metanephros or true kidney. 5. Vena renalis. 6. Ureter. 7. Vena spermatica. 11. Abdominal aorta. (In this diagram the division of the aorta into A, sacra media and the two common iliacs is as in man. In the other diagrams the condition existing in the cat is shown, that is the origin of all the vessels from the aorta.) 16. Vena iliaca transversa, connecting the left iliac vessels with the right. It forms a part of the left common iliac vein of the adult (Quain '92, p. 545). 22. Postcardinal* vein. (It is interrupted as a single vessel by the great venous plexus of the mesonephros or Wolffian body (Minot, '98, Parker and Tozier, '98) so that it has a caudal and a cephalic segment.) 23. Precardinal or jugular vein. 24. Cloaca. 25. Mesonephric or Wolffian duct from which are evaginated the true kidneys and the ureters (3).

*For the nomenclature of the cardinals, the suggestion of Parker and Tozier ('98) has been followed.

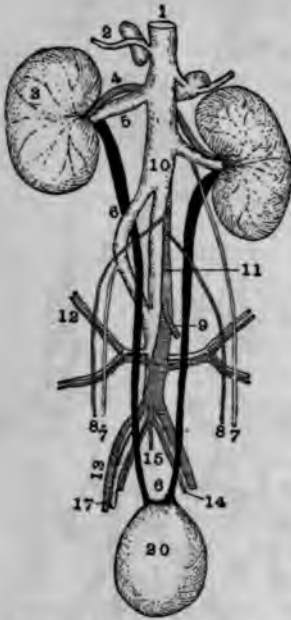


Fig. 6.—Ventral view of the blood vessels and of the ureters in a male cat; half natural size. To show the right ureter passing through a ring in the postcava. The spermatic vein of this side joins the outer part of the ring in the postcava. Numerals as in Fig. 1.

grows entirely through the postcardinal on both sides and is then ventro-laterad of the vein (Fig. 1 (4)). If this marvelous growth of the ureter through the vein does not take place, then the original, dorsal position of the ureter persists (Fig. 2 (3, 7)). The dorsal position of the ureter in these cases is simply a persistence of a normal, embryonic condition.

Why this embryonic condition should persist in all cases of double postcava is difficult to understand. If the writer has not mistaken the statements of Hochstetter ('93), the ureters normally grow through the postcardinals on both the left and on the right sides; that is in a very early stage, apparently before it had been determined which should persist as the postrenal segment of the postcava (Fig. 1 (4)).

If one were to explain the position of the ureters on purely mechanical grounds, viz: that the dorsal position would be liable to result in pressure on the ureter and thus retard the flow of urine, the explanation would seem very reasonable. It might further be pointed out that to avoid the danger of pressure with the "double postcava" there is a marked lateral curvature of the veins at the crossing point of the ureters. There still remains the difficulty, however, where the ureter passes to the dorsal side in cases like that shown in Fig. 3, where the veins are practically normal. The fact remains that in every case of persistent right and left postcardinal veins the ureters have been found on the dorsal side of the veins whether the veins were approximately equal or very unequal in size (Fig. 2 (3)). There are apparently cases where the right ureter is on the dorsal side of the postcava, and the left is wholly free from veins by the complete disappearance of the postcardinal between the iliac and the spermatic. It is believed,

however, that careful dissection will in most cases reveal a persistent left postcardinal, although it may be very small, as in Fig. 3 (22).

In every case so far investigated and in all the descriptions so far read the ureters have always been found on the dorsal side of the spermatic vessels. This is shown in all the accompanying figures and would indicate that the point where the ureter grows through the postcardinal is always caudad of the junction of the spermatic vein.

One specimen, prepared some ten years ago (Fig. 7), does not readily fall into any of the previously considered groups of anomalies. As this preparation was made before the full significance of minute anastomosing veins was appreciated, some branches, which would make a satisfactory explanation more easily possible, might have been lost. From the relations of the spermatic veins it would appear that on the left the postcardinal element between the spermatic and the iliac vessels had disappeared as in normal cases. From the relations of the left vein with the aorta it would appear that in the embryo there was present an unusually long *Vena iliaca transversa*, thus giving rise to a very long left common iliac in the adult. There is no anastomosis in the pelvic region between the right and left common iliacs. The relations there are as shown for the specimen in Fig. 2 (see Fig. 8). At first sight this specimen appeared like an example of a "double postcava," but the relation of the left vein with the aorta, its non-reception of the left spermatic vein, and the ventral position of the ureter all seem to preclude the hypothesis of a persistent left postcardinal. On the other hand, all these points favor the view that in this case there is present an unusually long left common iliac.

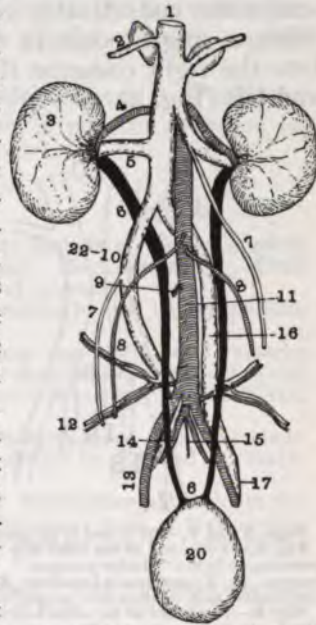
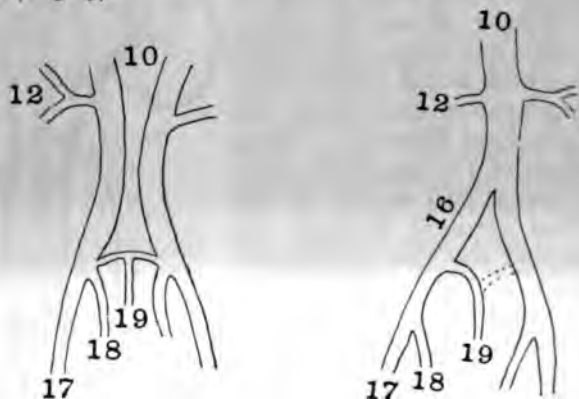


Fig. 7.—Ventral view of the blood vessels and ureters of a male cat, half natural size. This figure shows what is believed to be a very long, left common iliac vein. See the text. The ureter of the right side is dorsad of the postcava (22-10).

In case of a "double postcava" like that shown in Fig. 2, Hochstetter ('93, p. 635) described for the cat a double anastomosis on each side of the sixth lumbar artery. I have found no such anastomosis in the specimens dissected in this investigation. The only connection found in the pelvic region was through the junction of the middle sacral vein. This along the tail is single or in a kind of plexus. When about ready to unite with the iliacs it forms a kind of Y, sending a branch to each common iliac vein. Sometimes this union is very near the bifurcation of the external and internal iliacs, sometimes considerably cephalad of that point (Fig. 8, (9)). With a single postcava the middle sacral sometimes opens into the right common iliac only, sometimes into both right and left (Fig. 9).



Figs. 8 and 9.—Pelvic end of the great veins with double and with single postcava.

Fig. 8.—Pelvic end of the veins with "double postcava," from Fig. 2. 10. Postcardinals, both persisting to form a "double postcava." 12. V. ilio-lumbalis. 17. V. iliaca externa. 18. V. iliaca interna. 19. V. sacra media (caudalis), dividing and sending a branch to each common iliac vein. (In this case each common iliac merges insensibly into a postcava.)

Fig. 9.—Pelvic end of the veins with a single postcava, from Fig. 1. Numerals the same as in Fig. 8. In this case the middle sacral or caudal vein remains single and unites with the right common iliac. Sometimes, as indicated by the dotted lines, a branch is sent to each common iliac as in Fig. 8.

While it has not been the purpose of this paper to deal with variations in the vessels in general, considerable differences of a minor character were found, especially in the renal vessels, and these differences have been indicated in the different drawings. Perhaps one of the most striking differences in cat and man is the relative position of the kidneys; in man, the right being farther caudad than the left, while in the cat the left is farther caudad. Occasionally they are nearly

on a level, as shown in Fig. 7. Usually, also, the left renal vein in the cat is markedly nearer the pelvis than the right, but it may join the postcava nearer the heart than the right (Fig. 7). The adreno-lumbalis, especially on the left, may join the renal instead of the postcava (Fig. 1). And, finally, it is not uncommon that both renal artery and vein of one or both sides may be double or triple for all or a part of their extent (Fig. 2).

From the elongation of the cat's trunk, and the frequent presistence of the embryonic arrangement of the great veins and the ureters, this animal seems especially favorable for investigations upon the development of the urinary organs and the great veins.

In closing I wish to express my indebtedness to Professor Wilder, to Dr. Huntington and to Dr. Minot for material or for suggestions.

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VISCERAL AND VASCULAR VARIATIONS IN HUMAN ANATOMY.

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[To be published elsewhere.]

In the discussion DR. TERRY asked Dr. Huntington if he had ever found the common iliac veins ventral to the corresponding arteries.

DR. HUNTINGTON replied that he had.

DR. TERRY then said that his cousin, Dr. Todd, of St. Louis, had called attention a number of years ago to the pressure made on the common iliac veins as they rested on the spine, by the pulsations of the right common iliac artery in crossing them. In view of the absence of valves in the inferior vena cava, and the *downward* pressure of the long column of blood therein from the erect position of man, Dr. Todd regarded this valve-like action of the right common iliac artery as an important factor in relieving the pelvic tributaries of the inferior cava from pressure, and so helped to maintain the venous circulation in this part of the body.

DR. SHEPHERD said that he had seen quite a number of cases of double inferior cava; had reported several, the specimens of which were in his Museum. One case was reported in his article on Anomalies of Veins in Buck's Reference Handbook of the Medical Sciences, where there was a transverse branch *above* and *below* the *duodenal orifice*. He thought that the finding of the ridge mentioned by the author of the paper on that subject would not assist us much, but that the orifice of the common bile duct would be quite as easy for an educated finger to find as the ridge; of course if a gallstone were present the orifice would be more easily located.

NOTE ON THE STAINING OF ISOLATED
NERVE CELLS.

[Abstract.]

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One of the things most needed by the neuro-histologist and neuro-pathologist is to be able to see clearly the ectal surface of the nerve cell and some of its processes, with a minimum amount of machinery and manipulation. For the pathologist time is an important factor.

It is very difficult to orientate the smaller processes of unstained cells from the surrounding neuroglia. The same is true, in many instances, of sections.

The staining of dissociated cells upon the slide is unsatisfactory, because, after isolation, every manipulation tends to lose the cells.

After many trials and numerous failures the following method has been devised. The dissociator consists of the classic "normal salt solution," sterilized by the addition of 0.05 per cent.* formal (40 per cent. formaldehyde), and containing a dye, methylene—blue, green or violet. Methylene blue has been the most satisfactory. The cells are dissociated and stained at the same time.

The dissociated cells are mounted in sterile, alkaline, normal salt solution and sealed with shellac. If one is not ready to examine the tissue within 24 to 48 hours, it should be put into fresh dissociator containing 1 per cent. formal.

The dissociator—

Methylene blue,	. . . . .	0.5	gram.
Sodium chlorid,	. . . . .	6.	gram.
Formal (40 per cent. formaldehyde),	. . . . .	1.	cc.
Distilled water, sterile,	. . . . .	1000.	cc.

The mounting medium—

Sodium chlorid.,	. . . . .	6.	gram.
Formal,	. . . . .	15.	cc.
Distilled water, sterile,	. . . . .	1000.	cc.

* This is practically the formaldehyde dissociator recommended by Professor S. H. Gage, *Proc. Amer. Mic. Soc.*, XVII, 1895, p. 328, to which has been added a dye.

Five per cent. caustic potash solution, sufficient to make the mixture alkaline to litmus paper.

The mount is to be sealed with shellac and studied with any power.

The Method.—Small bits of nerve tissue, as fresh as possible, are to be immersed in a vial of the dissociator containing about 40 times as much fluid as tissue, for 24 to 36 hours. Then remove the mass of tissue and rinse off the surplus stain in a watch glass containing some of the alkaline mounting medium.

Remove a small bit of the tissue, transfer to a slide, and tease with needles as fine as possible. Then apply a $\frac{7}{8}$ -inch cover glass and press down firmly and repeatedly to further complete the isolation. Remove surplus fluid with absorbent paper and seal the preparation with shellac. A bit of tissue about the size of a pinhead will be sufficient for one preparation.

The mounting medium must be alkaline to litmus or the preparations will soon fade.

The advantages claimed for this method are the following:

1. The results are positive.
2. It gives a satisfactory stain for isolated nerve cells.
3. It economizes time and labor, which is important from a clinical standpoint.
4. Examinations may be made in 24 hours after the removal of the tissue. There are no sections to cut and no tedious staining process. The cells are shown either *in situ*, or completely isolated.
5. The formal fixes the protoplasm of the cell body and dendrites. So far as can be determined by comparison with the standard methods of Golgi, Nissl and Weigert, the cell suffers no change.
6. The cells stain deeply, the neuroglia stains only faintly and diffusely, if at all.
7. The cell is rendered transparent. Its exterior can be examined. Its interior may also be seen in optical section.
8. With suitable light and magnification, cell structure including gemmules, Nissl bodies, and in favorable preparations a nuclear network, are well shown.
9. Blood vessels and the finer capillaries are stained.
10. Pathologic changes in cells and blood vessels may be determined. Naturally some processes will be broken off.

This will happen with any dissociation method. In section methods, processes are cut off.

If the reader is skeptical about the merits of this method he is requested to give it a fair trial before condemning it.

Addendum.—Since the foregoing was written my attention has been called to "A Method of Examining Fresh Nerve Cells," etc., by John Turner, M. B. (*Brain*, Vol. XX, 1897, p. 450). In this method "a thin slice of cortex is placed direct in a 0.5 per cent. aqueous solution of methylene blue (Grubler, B. x.) for from 3 to 12 hours. A very thin slice, including the entire depth of the cortex, is removed by a scalpel and mounted in Farrant's solution. A cover glass is applied and the film of cortex is further flattened by pressure upon the cover glass, with the handle of a mounting needle. The preparations do not keep more than 10 days, but can be kept a few days longer and rendered sharper by heating the slide until it is just too hot to bear upon the back of the hand." Mr. Turner is enabled to demonstrate pathologic changes in cells and in the chromatic substance of Nissl.

EXAMINATION OF THE CAECUM AND APPENDIX IN ONE HUNDRED SUBJECTS.

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[To be published elsewhere.]

In the discussion DR. SHEPHERD said that he believed that the obliteration of the lumen of the appendix was a pathological, and not a normal process. The occurrence of constrictions in the appendix gave rise to much trouble, preventing the exit of the contents. He asked Dr. Martin if he had observed the proportion of cases in which a floating caecum existed, as in these cases the appendix might be anywhere; he had found it lying in the lesser omentum. He also asked if the caecum was not always found empty. He himself utterly disbelieved in the occurrence of impaction of feces in the caecum except in cases of stricture beyond.

DR. LAMB said that he had often seen fecal accumulation in the caecum.

A PRELIMINARY ACCOUNT OF THE DEGENERATIONS IN THE CENTRAL NERVOUS SYSTEM OF FROGS DEPRIVED OF THE CEREBRUM.

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For twelve years it has been the custom of Professor Wilder to exhibit decerebrized frogs to his classes in physiology. One of these was kept alive for more than eight months. Several have been preserved with the brain exposed, but with reference to the macroscopic rather than the microscopic evidences of repair and degeneration.

I have been interested to know what changes occur in the tissues of the central nervous system as a result of such an operation.

Surely the careful microscopic examination of an animal thus mutilated ought to give us at least some clew to the way in which the intelligence exerts its influence over the remainder of the organism. For from Waller's law of the degeneration of nerve fibers, it ought to be possible to determine the location and relations of fibers which arise from cells in the cerebrum and are distributed to the remaining portions of the brain and myel.

If the cerebrum is the organ of conscious thought, and we are able to remove it and to keep the animal alive long enough for recovery to take place and for degenerations to occur, is it not then possible to divorce the intelligence—the ego—from the non-ego or purely vegetative portion of the organism? And may we not, from the degenerations found, form some idea of the organic basis of the ego and of its relations to the non-ego?

It is well to begin this study with the frog because—1. Its nervous system is less complex than that of mammals. 2. The operation for decerebrization is simple and painless. 3. The frog may be easily kept alive for several months. 4. Careful observations and comparisons may be made with normal frogs kept under the same conditions.

Observations on decerebrized frogs have been published by Flourens (1822), Vulpian (1861), Goltz (1869), and others. But, so far as I have been able to learn, they were confined to the observation of its behavior.

Method of study.—The frogs I have studied possessed all of their reflex and sensory apparatus excepting the cerebrum and the olfactory bulbs.

A normal and a decerebrized frog were kept upon the same table, during a part of the time in the same jar. Their behavior under identical conditions was carefully observed.

Transections were made of the myel and the remainder of the brain of a frog which lived for six months after its cerebrum had been removed. These transections were carefully compared with a like series made from a normal frog. Both series received similar treatment by the same reagents.

Behavior of the normal frog.—1. He manifests fear. 2. He endeavors to escape. If he succeeds he will conceal himself behind the nearest object. 3. Food left hanging from the lips will usually be swallowed; sometimes, however, it will be brushed away. The normal frog certainly does possess an appreciable amount of a certain kind of intelligence.

If the reader is inclined to doubt that the frog possesses any intelligence, I ask that he catch one, care for him, study him, then he will no longer doubt.

Behavior of the decerebrized frog.—1. He habitually sits motionless. No spontaneous movements were observed, excepting the changes of position such as may be observed in sleeping animals and human beings.

2. His attitude and general reflex activity are largely dependent upon nutrition and environment. Sometimes he sits very erect, more so than the normal frog. At other times he settles down and rests upon his venter as a normal frog sometimes does.

3. He usually reacts promptly and vigorously upon the application of various stimuli. If he has been resting for some time and is full fed, he will react to visual and perhaps to auditory impressions also. He will jump at every blow upon the floor or table, or at the near approach of a moving object. At times he appears as though he were blind and groping in the dark.

4. The reflexes seem to be exaggerated, as though a possible inhibiting influence of the cerebrum had been removed. In some specimens the reflex of vomiting is greatly augmented. Unless special care was taken, one frog would retch so violently as to cause a complete prolapse of the stomach every time he was fed.

5. When grasped in the hand he struggles violently until either he escapes, or exhausts his nerve cells. If he escapes he makes a few leaps and then comes to rest. Sometimes when one reaches to grasp him he will turn and make a few jumps away from his pursuer.

6. Food placed in the mouth will usually be swallowed. If it projects from the mouth over the lips the hand will be raised and brush it away. Sometimes if the mouth is packed full of bits of meat, it will be opened and the food removed with the hand.

7. All bodily functions appear to be normally performed, and with liberal nourishment there is an apparent gain in size and weight.

In short, the decerebrized frog is a non-ego. He knows nothing, fears nothing. He has even lost all instinct for self-preservation. With reasonable care he will live and thrive for an indefinite period. He represents merely a certain amount of potential nervous energy which responds only to external stimuli.

Nerve-elements in the normal frog.—The neuron (cerebro-spinal axis) of the frog comprises a considerable amount of neuroglia arranged in the form of an open net work in the meshes of which the nerve-elements are supported. The neuroglia stains less deeply. In the present paper, fibers only will be discussed. From their reaction to stains the fibers may be divided into two groups: (a.) The fibers stain intensely. (b.) The fibers stain less intensely. This distinction was observed in a less degree in the decerebrized frog.

In transections, the fibers appear to vary in outline from circular to polygonal and triangular. Careful examination of transections and longisections with a high magnification shows that the fibers (of the myel at least) are not cylindric and of a uniform caliber, but rather of an irregular outline and beset with very minute thorn-like outgrowths which appear to be attached to the network of supporting neuroglia. In all cases a careful comparison of normal and of pathologic tissue has been made. Since these outgrowths are located at intervals along the fiber, some of the fibers show them and some do not. Normal fibers in the dorsal zone of the myel have an approximate diameter of from four to six microns.

Pathologic appearances.—The degenerations observed in a frog which lived six months after decerebrization were :

I. Macroscopic.—1. A collapse of the cavities. 2. A shrinking and corrugation of the parietes. See plate, Figs. 8 to 12. 3. There is no regeneration of the removed parts, at least within seven and one-half months after the operation.*

II. Microscopic.—An apparent increase in neuroglia, presumably due to a disappearance of nerve fibers and the collapse of the meshes of neuroglia. Since this frog lived for six months, it is probable that many fibers had already disappeared. The degenerated fibers vary in diameter from two to five microns. They were found in transections all the way from the diencephal to the myel. They are distributed throughout both the dorsal and ventral regions of the neuron but are found most plentifully in the ventral region. They are stained in a characteristic manner by Delafield's hematoxylin and hydrochloric acid carmine stains. In transection the fibers appear shriveled or shrunken and pale yellowish-brown. Sometimes they have a metallic appearance. In some the center of the fiber will take the stain while the periphery will remain pale. Certain fibers appear to be breaking up into minute granules. In many cases only an empty mesh in the neuroglia remains. The neuroglia has a normal appearance with the exception that many of the meshes are collapsed.

Normal fibers appear plump and, for the most part, stain intensely.

The paths of degenerated fibers.—I have been able to section the neuron of only one decerebrized frog. It was cut in transections. Degenerated fibers were found intimately mingled with normal fibers in all the brain segments and myel. Compare figures 8 to 12.

The diencephal.—Degenerated fibers are very plentiful in the ventrolateral region. They lie close to the ectal surface, and are found in the greatest numbers about midway between the dorsum and venter. See Fig. 8.

The mesencephal.—Here, as is to be expected, the greater number of degenerated fibers are found in the crura. They

* In the case of a specimen of *Rana catesbiana* which met with accidental death eight months after decerebrization, and in which the olfactory bulbs were not removed, it was found that a thin neck of tissue apparently nervous, and covered by pia had grown caudad from the olfactory bulbs to connect them with the diencephal. This occurrence is to be expected from Waller's law. The brain will be sectioned and reported upon at a later meeting.

lie mostly in the ventral portion, but there are many near the periphery all the way from the venter to the dorsum. A considerable number are found in the gemina. There are also some degenerated fibers in the entocinerea ("central tubular gray"). In this segment there is seen for the first time an evident collection of the fibers into distinct bundles. See Fig. 9.

The epencephal.—This segment exhibits the appearance of collapse more strongly than the preceding one. The epicle is perceptibly narrowed and distorted. The larger number of degenerated fibers are to be found in the preoblongata, but a considerable number are distributed to the cerebellum. Some fibers are larger than others. The grouping into distinct bundles is more marked than in the mesencephal.

The metencephal.—Here the reduction of the metacele and the consequent distortion of the parietes are more marked than in any other segment. Compare Figures 5 and 11, plate. The distribution of degenerated fibers is, with a few exceptions, approximately the same as in the epencephal. A few fibers were found in the entocinerea and near the metacele.

The myel.—Transections of the myel show a corrugation of the parietes and collapse of the myelocle. There is an apparent decrease in the number of degenerated fibers. It seems reasonable to suppose that some fibers would terminate in the oblongata. The fibers are confined chiefly to the alba, but a few are found in the entocinerea ("central tubular gray"). They are now collected into distinct bundles, which are distributed most abundantly to the great sensory and motor regions of the myel. One bundle is located in the dorsomesal region of the cinerea near Clark's column of cells. A few fibers are found near the myelocle.

SUMMARY.

1. The normal frog manifests fear; tries to escape; if he succeeds, conceals himself behind the nearest object; usually takes into his mouth and swallows food that hangs from his lips. In brief, he leads an independent existence, governed by a certain amount of intelligence.

2. The decerebrized frog is deficient in the above respects; he leads an entirely dependent existence.



3. Reflexes are exaggerated. They are, however, modified somewhat by the conditions of rest and of nutrition.

4. There is no regeneration of the part removed, at least within seven and one-half months after the operation.

5. Degenerated fibers are found in the remainder of the brain and myel.

6. Beginning at the crura, there is an appearance of the grouping of fibers into bundles.

7. In the myel the massing is quite obvious. There are distinct bundles and some scattered fibers, which are distributed to all regions of the myel. This frog lived for six months. It is probable that some fibers have entirely disappeared.

8. Degenerated fibers differ from normal ones in that they are smaller and have a shrunken appearance. They also react differently to Delafield's hematoxylin and carmine stains. They appear pale or yellowish-brown. Normal fibers stain deeply.

9. The decerebrized frog is a non-ego. The remaining normal elements represent the reflex and vegetative portion of the organism.

10. The degenerated fibers represent the pathways through which the ego exerts its influence upon the non-ego.

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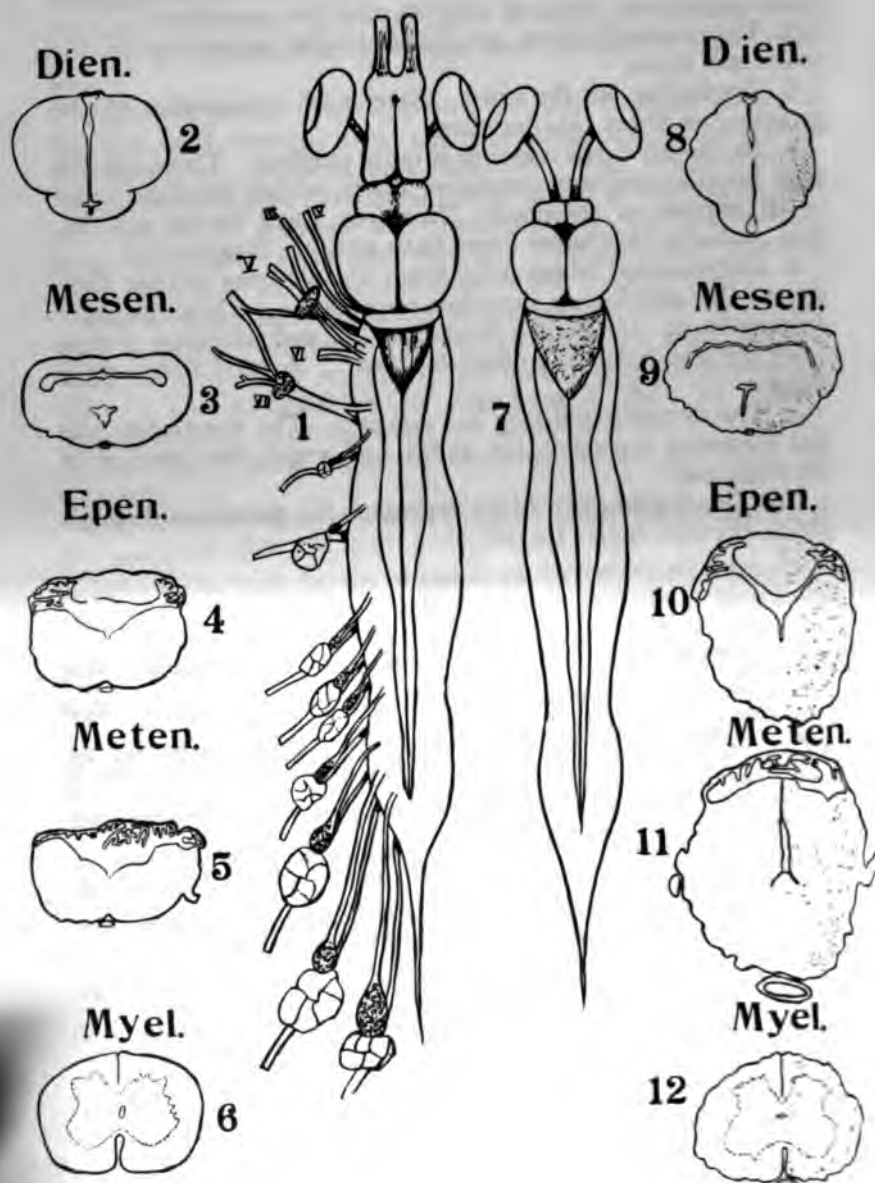
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Normal Frog.

Decerebrized Frog.



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DESCRIPTION OF PLATE.

The plate represents the dorsal aspect of the neurons (central nervous systems) of a normal and a decerebrized frog. Fig. 1 (modified from Wyman, '52) shows that of the normal frog. The nerve roots are omitted from the right side. The metatela was removed to show the metacele. Figs. 2 to 6 represent transections through the four caudal brain segments and the myel of a normal frog. Fig. 7 represents the neuron of the decerebrized frog. With the exception of the nerve roots, which are omitted from both sides, the only difference between the two frogs is in the absence of the olfactory bulbs and the cerebrum. The brain was transected through the diencephal just cephalad of the chiasma, and without injury to the optic nerves. Vision and reflexes dependent upon the sense of sight apparently were not interfered with.

Figs. 8 to 12 represent transections through the four caudal brain segments and the myel of the decerebrized frog's neuron. The dots represent degenerated fibers. They are omitted from the left side. The parietes are collapsed, corrugated and the cavities are reduced and asymmetric.

The inner black lines in Figs. 2 to 6 and 8 to 12 represent endyma.

Defect.—The perpendicular line in Fig. 8 represents apposed endymal surfaces. It should be continuous.

SPECIMENS SHOWING BY A NEW DISSECTION THE INTERNAL STRUCTURE OF THE HIPPOCAMPUS.

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et seq.]

THE STERNALIS MUSCLE.

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[To be published elsewhere.]

In the discussion DR. SHEPHERD said that Dr. Huntington had not alluded particularly to the occurrence of the muscle in anencephalous monsters, which are, by the way, nearly always females. Its occurrence was always accompanied by deficiency of the great pectoral. He fully believed that in every case the sternalis muscle was supplied by a branch of the anterior thoracic vessels; and whether the pectoral group was an offshoot of the panniculus group or the panniculus derived from the pectoral, he was certain that the sternalis muscle belonged to the pectoral group. In all cases which occurred high up, this anomalous muscle was overlapped by the *platysma myoides*.

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GEOGRAPHICAL DISTRIBUTION OF MEMBERS.

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Canada,	5	England,	3
Illinois,	4	Germany,	3
Maryland,	3	France,	2
Texas,	3	Ireland,	1
Louisiana,	2	Scotland,	1

Total: 141 = 131 active, 10 honorary.

PROCEEDINGS
OF THE
TWELFTH ANNUAL SESSION
OF THE
Association
of
American Anatomists,

HELD AT
YALE MEDICAL SCHOOL, NEW HAVEN, CONN.,

DECEMBER 27 AND 28, 1899.



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PROCEEDINGS OF THE TWELFTH ANNUAL SESSION.

The twelfth session of the Association of American Anatomists was held at the Yale Medical School, New Haven, Conn., in conjunction with the Society of American Naturalists and affiliated societies, December 27 and 28, 1899. Nineteen members attended: Blake, Ferris, Gerrish, Herrick, Holmes, Hrdlicka, Huber, Lamb, Mackenzie, Mall, Mellus, Miller, M. B. Moody, R. O. Moody, Minot, Piersol, Tuttle, Shepherd and Wilder.

WEDNESDAY, DECEMBER 27TH.

The Association was called to order at 10.10 A. M., by the President, Dr. Wilder, who delivered an address, "Historic, ethical and practical considerations respecting the names and numbers of the definitive encephalic segments."

There were presented facts and arguments in favor of maintaining the customary method of enumerating the segments of the brain beginning with the most cephalic or "anterior," and in favor of retaining for five of these segments the names, *prosencephalon*, *diencephalon*, *mesencephalon*, *epencephalon* and *metencephalon*, which were adopted or proposed in 1867 by the editors of the seventh edition of "Quain's Anatomy." In particular it was shown that the replacement of *metencephalon* by "myelencephalon" for the last (oblongatal) segment, as done by Huxley and in the B. N. A., is not only unjustifiable on historic and ethical grounds, but practically objectionable because it apparently involves the retention of the lengthy and unrelated terms of the B. N. A., viz: "myelencephalon," "ventriculus quartus," "tela chorioidea ventriculi quarti," "plexus chorioideus ventriculi quarti" and "apertura medialis ventriculi quarti" (foramen Magendii), and the abandon-

ment of the series of correlated single-word terms, *metencephalon*, *metacoelia*, *metatela*, *metaplexus* and *metaporus*. (The address will be published in *Science*.)

The Executive Committee recommended the election of the following candidates for membership, viz : Mackenzie, Mellus, Miller, Primrose and Small [see list of members]. On motion, the Secretary was directed to cast the ballot for them, and they were elected.

The report of the Secretary and Treasurer was read and accepted. The following extracts are made :

The last report showed that the Association was in debt to the amount of \$147.83 ; of which \$50.00 was due the printer, \$7.75 to the President for expenses incurred, and \$90.08 due to the Treasurer for money advanced to pay bills. During the year the receipts from dues have been \$355.25, and the expenditures, \$351.53. The expenditures include the two bills just mentioned, amounting to \$57.75. The money advanced by the Treasurer is still unpaid. It will be observed that the income and expenditures have almost exactly balanced each other. The income for the succeeding year may reasonably be estimated at \$350.00 ; our ordinary expenses will probably be about \$300.00, leaving a balance of about \$50.00 towards cancelling the present debt to the Treasurer.

If, however, this Association should take part in the Congress of American Physicians and Surgeons next May, the additional expense will be about as follows : For the usual preliminary notices and for publication of our own Proceedings and mailing them, about \$225.00. The Congress publishes only its Proceedings as a Congress. Our share of the expenses will be about \$100.00, which would be called for probably in the year 1901 ; we would not necessarily, therefore, have to provide for it next year. To raise the \$225.00 mentioned will require either an increase in the dues or a special assessment. I think that if we decide to meet with the Congress it would be preferable to make an assessment. An assessment of \$2.00 per member would probably bring to the treasury the \$225.00 named. An assessment of \$3.00 per member would probably bring \$325.00, which would cover the entire expense to us of the meeting of the Congress. It is only fair to the Treasurer to state that

neither of these propositions, if carried out, would certainly reimburse him. There is no provision in the constitution either for or against assessments.

The amount of dues in arrears is \$134.00; 16 members owing for one year, 9 for two years, and four for three years. Under the law the names of these four members should have been dropped at the close of the last meeting; but the Treasurer has retained their names because several other members in like situation have paid. However, unless they also pay arrears at an early date, he will feel it a duty to drop their names.

The expenditures consisted of \$4.80, our share of the expenses of the New York meeting; \$16.01 paid the President, who is also Secretary of the Committee on Anatomical Nomenclature, for expenses incurred; \$30.50 for postage; \$273.35 for printing, which, as stated, includes the \$50.00 due from last year; \$6.29 for copying and express charges; \$18.67 for expenses of Secretary and Treasurer in attending the last meeting, and according to a resolution passed by the Association at that meeting providing for the reimbursement to the Secretary of his railroad fare and \$10.00 towards hotel expenses; and \$1.91 to reimburse the Treasurer on account of the subscriptions to the *Journal of Anatomy and Physiology*. In this connection it must be stated that through inadvertence it was announced by the Executive Committee in a circular of January 31, 1899, that the subscription price of that journal was five dollars. As a matter of fact, however, the price is 21 shillings or \$5.11, to which the cost of money orders must be added. The Secretary received in all eleven subscriptions, which, with the cost of money orders, amounted to \$1.91 more than his receipts at five dollars a subscription. Under the circumstances he thought it only right that the small balance should be paid by the Association. It will be best, however, for the Association to express its wishes as to further subscriptions. The balance due the Treasurer is \$86.36.

The Proceedings of the last session were duly published and sent to members and others. Additional copies were sent to the officers, to those who contributed papers, and to any one else requesting them. There are 25 libraries on the mailing list. A number of sets of the last six volumes are in hand available for members or libraries. The first five volumes, which are now out of print, can be reprinted as one pamphlet for \$80.00 for

200 copies, and I would recommend the reprinting as soon as our funds will permit. The Secretary is constantly receiving requests for these back numbers.

During the year we have lost 9 members. One honorary member, Prof. Sir Wm. Henry Flower, the Director of the Natural History Department of the British Museum, died July 2, 1899; it is suggested that the vacancy be filled at this session by another English anatomist. Prof. Othniel C. Marsh, Professor of Palaeontology and Curator of the Geological Collection at Yale University, died March 18th. One member, Dr. John Lindsay, Assistant Demonstrator of Anatomy at Jefferson Medical College, died December 23, 1898, a few days before our last meeting, but the Secretary was not advised of the death until sometime afterwards. Six members have resigned: Dr. E. A. Balloch, late Demonstrator of Anatomy at Howard University Medical Department, Washington, February 1, 1899; Dr. Nathan E. Brill, late Lecturer in Anatomy, Physiology and Pathology of Nervous System, Post-Graduate Medical School, New York City, December 18th; Dr. John B. Deaver, Assistant Professor of Applied Anatomy at the University of Pennsylvania, February 2d; Dr. John D. Erdmann, Professor of Practical Anatomy Bellevue Hospital Medical College, after accepting election, resigned January 26th; Dr. J. Ewing Mears, Professor of Anatomy, etc., College of Dental Surgery, Philadelphia, October 23d; Dr. Joseph P. Tunis, Assistant Demonstrator of Anatomy and Surgery University of Pennsylvania, December 18th. At present there are 125 active and 9 honorary members; total, 134.

A committee consisting of Drs. Holmes and Blake was appointed by the President to audit the accounts of the Treasurer.

The resignation of Dr. Frank Baker as a member of the Committee on Anatomical Nomenclature was accepted, and the President appointed Dr. H. B. Ferris to fill the vacancy.

The report of the Committee on Nomenclature was read by the Secretary, Dr. Wilder (Dr. Piersol, First Vice-President, in the chair), who, in the absence of Drs. Huntington and Spitzka, (Drs. Gerrish, Wilder and Ferris present), reported progress and asked the Association to consider, with a view to decisive

action at the next session, the following names for constituents of the peripheral nervous system. Where a single term is given it is the one adopted by the B. N. A., and also preferred unanimously by the Committee. Where two terms are used the first is the one in the B. N. A., but this does not imply that it is preferred by the Committee.

Nervi cerebrales vel craniales.

Nervi olfactorii,
 Nervus opticus,
 " oculomotorius,
 " trochlearis,
 " trigeminus vel trifacialis,
 Nervus ophthalmicus,
 " maxillaris,
 " mandibularis,
 Nervus abducens,
 " facialis,
 " acusticus vel auditorius,
 " glossopharyngeus,
 " vagus,
 " accessorius,
 " hypoglossus.

Nervi spinales.

Nervi cervicales,
 Plexus brachialis,
 Nervus musculocutaneus,
 " medianus,
 " ulnaris,
 " radialis.
 Nervi thoracales,
 " lumbales,
 " sacrales,
 Nervus coccygeus,
 Plexus lumbalis,
 " sacralis,
 Nervus iliohypogastricus,
 " ilioinguinalis,
 " genitofemoralis (genitocruralis),
 " obturatorius,
 " femoralis (cruralis anterior),
 " ischiadicus vel sciaticus.

Systema nervorum sympathicum.

Truncus sympathicus,
 Ganglia trunci sympathici,
 Plexus sympathici,
 Ganglia plexuum sympathicorum.

A brief report was read from the Delegate to the Executive Committee of the Congress of American Physicians and Surgeons, Dr. Brockway.

Dr. Lamb, from the Committee on Anatomical Peculiarities of the Negro, reported that no progress had been made; all the blanks had been distributed; two had been returned, namely, by Mr. Charles Ward, of Rochester, N. Y. Some members thought that the blank was too elaborate; that it asked for too much. He asked what the Association wanted now to be done. No action was taken, but Dr. Wilder suggested reprinting and redistributing the blanks. The Committee on the Tables at Naples had no report to make.

Dr. Gerrish, for the Executive Committee, reported that, in view of the financial situation of the Association, as shown by the Treasurer's report, the committee would recommend that the Association assess the members sufficient to cover the necessary expense of its connection with the Congress of American Physicians and Surgeons, or withdraw from the Congress. Dr. Gerrish made a motion in substance as stated; seconded. Discussed by Drs. Wilder, Ferris, Lamb, Gerrish, Holmes, Blake, Tuttle, Shepherd and Moody.

Dr. Holmes moved as a substitute to increase the annual dues to \$4.00. Dr. Blake moved to amend by making the dues \$5.00, and that the Association retain its membership in the Congress. Dr. Holmes withdrew his motion, and the vote was then taken on Dr. Blake's motion, which was carried; no negative vote.

A letter was read from Dr. E. Aubrey, Detroit, Secretary of a committee formed to secure interstate reciprocity in granting licenses to physicians, asking the coöperation of this Association. The discussion showed that the members present did

not think the subject a proper one to be acted upon by this Association, and, on motion of Dr. Gerrish, its consideration was indefinitely postponed.

The President appointed Drs. Piersol, Mall and Ferris, a committee to report nominations of officers for the ensuing term.

Dr. Hrdlicka read a paper, illustrated by specimens and diagram, on "The normal and anomalous divisions of the parietal and temporal bones in man and in the mammalia."

The Association took a recess at 1.10.

Reassembled at 2.45 P. M.

2. Dr. Hrdlicka read a paper on "Further investigations of the human tibia." Discussed by Drs. Gerrish, Wilder, Hrdlicka and Lamb.

Dr. Holmes, of the Auditing Committee, reported that the accounts of the Treasurer were correct. Report accepted.

3. Dr. Holmes read a paper on "The deep fascia." Discussed by Drs. Gerrish and Wilder.

4. Dr. Mackenzie read a paper on "The facial expression of fatigue and violent effort." Illustrated by photographs and lantern slides.

5, 6. An abstract of a paper by Dr. Keiller on "How best to teach anatomy to third year medical students," and of another paper by the same author on "Notes on the relation of the external carotid," were read by the Secretary. The first paper was a brief sketch of a course of dissections of direct surgical and medical interest, and leading up to an operative course, being the third year's course of practical anatomy at the University of Texas.

7. Remarks were made and slides shown under the microscope by Dr. Minot "On a hitherto unrecognized form of vertebrate blood circulation in organs without capillaries." Discussed by Dr. Blake. [See *Proc. B. S. N. H.*, Vol. XXIX.]

8. A paper by Dr. Blake, illustrated by chart and specimens, on "Early embryonic closure of the aortic valve with consequent non-development of the left ventricle and aorta." Discussed by Dr. Minot. [To be published in *Jour. Anat. and Phys.*]

9. Paper by Dr. Huber on "Sensory nerve fibers in the visceral nerves, with remarks on their mode of termination." Illustrated by chart. Discussed by Drs. Wilder and Minot.

10. Dr. Huber also read a paper on "Sensory nerve terminations in the tendons of the extrinsic eye muscles of the cat." Discussed by Dr. Piersol. [For both papers, see *Jour. Comp. Neurology*, May, 1900.]

11. An abstract of a paper by Dr. Keiller on "The anatomy of the anal region," was read by the Secretary.

The Association adjourned to meet next morning.

THURSDAY, DECEMBER 28TH.

The Association reassembled at 9.40 A. M.

Dr. Gerrish, for the Executive Committee, reported that the Committee had agreed to give the opportunity to members to subscribe for the *Journal of Anatomy and Physiology* through the Secretary, at the price of \$5.30 per year. Also that the Secretary had been instructed to send a circular to the members who had read papers, requesting them to send to the Secretary within a fortnight after the meeting abstracts of the papers read, not exceeding 200 words each; otherwise the abstracts on the printed program would be sent to the editor of *Science* to appear in that journal.

Dr. Gerrish also recommended, for the Executive Committee, the name of John Cleland, of Glasgow, Scotland, as Honorary Member, in place of Sir William Henry Flower, deceased. The Secretary was instructed to cast the ballot for Dr. Cleland, and he was declared elected.

Dr. Piersol, for the Committee on Nomination of Officers for the ensuing term, reported the following:

- For President, G. S. Huntington, New York City.
- First Vice-President, F. H. Gerrish, Maine.
- Second Vice-President, G. C. Huber, Michigan.
- Secretary and Treasurer, D. S. Lamb, Washington, D. C.
- Delegate, J. A. Blake, New York.
- Alternate, Theodore Gill, Washington, D. C.
- Executive Committee, C. S. Minot, Massachusetts.

The report was accepted. On motion, it was decided to omit the election of Delegate and Alternate. On motion, Dr. Holmes cast the ballot for the other officers, and they were declared elected. The reading of papers followed.

12. "The delimitation of the divisions of the large intestine according to intrinsic features." By Dr. Gerrish. Discussed by Drs. Lamb, Piersol, Ferris and Shepherd.

13. "The normal capacity of the human bladder." By Dr. Gerrish. Discussed by Drs. Holmes, Lamb, Shepherd and Wilder.

14. "Comments upon the figure of the mesal (median) aspect of an adult brain as published by His and reproduced in the B. N. A." By Dr. Wilder. Illustrated by charts.

15. "If an Isthmus Rhombencephali, why not an Isthmus Prosencephali?" By Dr. Stroud. Read by Dr. Wilder. Illustrated by charts and specimens. Discussed by Drs. Herrick and Wilder.

16. "The basis and nature of a segmental schema of the brain." By Dr. Wilder. Illustrated by charts. Discussed by Drs. Miller, Wilder and Herrick.

17. "Is *Neuron* available as a designation of the central nervous system?" By Dr. Wilder.

18. Dr. Shepherd showed photographs of specimens of polydactylism and syndactylism.

On motion, the thanks of the Association were tendered to the Yale University, and especially to the Medical School, for courtesies; to the President, for his courteous fulfilment of the duties of his office, and to the Secretary, for his assiduity in the discharge of his duties.

At 1.00 P. M. the Association adjourned *sine die*.

DIVISIONS OF CRANIAL BONES IN MAN AND ANIMALS.

[Abstract.]

BY DR. ALES HRDLICKA, OF NEW YORK CITY.

Five classes of divisions are described and demonstrated, namely: (1) results of fractures; (2) normal, partial divisions in definite locations in the bones of the embryos and new-born; (3) anomalous partial divisions consequent upon the formation of a foramen in the ossifying bone; (4) divisions due to a retardation of the union of any of the normal segments of the bones; and (5) anomalous divisions due to an abnormal multiplicity of the centers of ossification. Class (2):—Two of the most prominent and constant of such divisions in man are the parietal incisure of Broca, and a squamous suture situated near the middle of the occipital border of the parietal bone (termed "parietal suture" by the author). Class (3):—Rare in man, so far as the bones of the cranial vault are concerned, but are common in the human superior maxillae in connection with the infraorbital foramen; they are very frequent in the parietal and temporal bones in mammals, particularly in the herbivora. Class (5):—Occur generally in the form of sutures dividing the whole bone or separating one of its angles. They are liable to be confounded with the previous and are somewhat allied to the same. These divisions are well known in the human parietal; the author has the records of eighteen new cases, found principally in macaques; one of the specimens presented before the Society, shows a bilateral division of the parietal bone in a chimpanzee. In lower mammals these divisions are extremely rare.

A FURTHER CONTRIBUTION TO THE STUDY OF THE TIBIA, RELATIVE TO ITS SHAPES (*VIDE* LAST YEAR'S TRANSACTIONS OF THE ASSOCIATION.

[Abstract.]

BY DR. ALES HRDLICKA.

An effort has been made during 1899 to learn the occupations of the subjects whose tibias had been examined. The

returns show a great diversity of occupations and even of classes of occupations, and it is plain that if any definite conclusions are to be reached, the investigations must extend over at least another thousand of subjects. The main indications so far are as follows: Inactivity of the lower extremities favors the persistence of the adolescent shape of the tibiae; considerable activity in the lower limbs, especially if of a definite kind, favors a differentiation in the shape of the bones. In the American Indians, who were always great walkers and did otherwise comparatively but little, types two and four of tibiae prevail. In strong, but also in rachitic individuals there is an inclination to type 3 of the bones. There was but little occasion to inquire into the influence of heredity on the shape of the tibiae, nevertheless such influence seems very probable.

THE DEEP FASCIA.

BY DR. EDMUND W. HOLMES, UNIVERSITY OF PENNSYLVANIA.

Next to the skin, there is no structure of the body interests me more than the deep fascia. The skin is a never ceasing source of admiration. It is a living wonder, covering us so completely; so sensitive, yet it protects us from pain; so delicate, so soft, so pliable, yet it shields us from death. There needs no deep or wide cut; an abrasion, a hang nail, or the puncture of a fine needle opening up the superficial lymph spaces may involve a hand or arm, or result in general sepsis. And against what a variety of poisons the skin defends us; from the staphylococci, and the streptococci, from erysipelas, tuberculosis, glanders, anthrax, and from syphilis. In our daily round of practice we are constantly endangered. Life, health and happiness, and the health and happiness of those who come after us largely depend upon the integrity of the skin.

Next to the skin, I wonder at the deep fascia, firm, tense, hard and shiny; with its wide spread extension and its complex agency. It lines the interior of the abdomen like a bag, protecting the various orifices from protrusion of the viscera; it forms ligaments for the organs and a floor for the pelvis; sheathes the vessels and muscles and frames canals for the

protection of delicate structures ; it binds muscles into groups, divides regions into spaces and sets organs off by themselves ; so that it may be fairly asserted that differentiation by fascial limitations means differentiation also into function.

Of the pathological conditions I can speak but briefly ; more than that would be out of place here. I have only to invite attention to the fact of pus from cervical caries pointing above or below Poupart's ligament to emphasize the practical importance of its study to the surgeon. In fact, sufficient care is not given to the fascias in our anatomical rooms ; for its careful dissection means a clean dissection, and as we all well know much of the usefulness of a dissection depends upon its neatness, while the manual dexterity attained will improve greatly the surgical technique, and by increasing the ease and celerity of operation may even improve the nomenclature by removing "swear words" from the surgeon's vocabulary.

Let us take up each region separately though omitting many points for want of time and space.

Some members may be surprised at my including the transversalis fascia among the deep fascias, but if we will stop and think a moment, we will recognize its supporting and investing as identical with that of the deep fascia, and also that the pubic portion of the fascia lata extending up under Poupart's ligament is continuous with the iliac covering the Iliacus muscle, which is in turn an extension of the transversalis, and posteriorly the transversalis fascia reappears near the surface as the lumbar fascia. It is but a trite observation, that after nature formed the bony muscular boundaries and the primary nervous trunks of the abdominal cavity she lined it with the transversalis fascia, as with a bag, and inside of this she put the viscera and the blood vessels leaving the nerve trunks outside to pierce from without inward to their distribution. She thus provided a firm, hard, smooth membrane for the viscera to move about on, to which the peritoneum is a valuable lubricating accessory. We denominate this the "sliding" function of this fascia. In passing, it shuts the Psoas and Iliacus from the general cavity, because although placed internally their use is crural rather than abdominal. So that when movements of the lower limb give intra-abdominal pain, or the reverse, we may be sure some pathological process is at work. Down in the pelvis the transversalis fascia passes from side to side to form a fibrous

diaphragm, with holes cut for the passage of the rectum, vagina and bladder, thus constituting an instance of the "supporting function." Above this fibrous diaphragm are the retentive portions of the viscera; the parts below, each surrounded by circular muscular fibres, are the sphincteric portions, the name we would apply to the membranous urethra, to the lower part of the rectum, and to the corresponding part of the vagina, surrounded by the levator ani. We have always been of the opinion that the graver forms of prolapsus uteri following perineal tears are due to the laceration of the recto-vesical fascia, resulting from the forcible impact of the child's head upon the aperture in the fibrous diaphragm; undue emphasis being given by writers to the Levator Ani muscles. Emmet's operation is effective because it repairs the fascia as well as the muscle. The anterior layer of the triangular ligament, separates the deep or sphincteric pouch, from the superficial pouch which in function may be designated as erectile. In the lumbar region the transversalis fascia divides into three leaflets ensheathing the *Quadratus Lumborum* and the *Erector Spinae*, thus separated from each other because of their different action. The femoral sheath with a threefold compartment for artery, vein and lymphatic, is another instance of separation indicative of separate function, as is a similar arrangement of the carotid artery, jugular vein and vagus nerve in the neck.

In the thigh, Poupart's ligament is a specialized protection for structures passing under the crural arch. Hunter's canal protects the vessels curving around the femur; the fascia of the popliteal space, the transverse intermuscular septum of the calf having a similar use, all illustrative of the "protective function" of the fascia; while the annular ligaments of the ankle and wrist with their diverticula secure the tendons, support their synovial covering and give them additional leverage. Upon the thigh we have three groups of muscles, the extensor, the adductor and the flexor, each enclosed with its nerve respectively, the anterior crural, the obturator, and the great sciatic. Superimposed upon the extensor group is the *Sartorius* which slips easily upon the broad plane of fascias beneath, thereby readily exercising its "tailor work." There are several muscles like the *Sartorius* having a separate ensheathment like a sword in its scabbard or an umbrella in its sheath: the *Psoas Magnus*; the *Gastrocnemius*, *Soleus*

and Plantaris in a group; and the Sternomastoid; these move readily upon the face of the fascia beneath because their play is peculiar and different from the subjacent muscles. Again in the thigh the extensor group with its anterior crural nerve is bound down by the fascia lata, but the Crureus and the two Vasti have their own ensheathment and were the Rectus Femoris merely a quadriceps extensor it would be bound down with them, but being also a flexor of the thigh upon the pelvis it is separated from the Triceps Cruris beneath, by a plane of fascia. In the calf we have already alluded to the intermuscular septum separating the three superficial muscles, the flexors of the foot from the three deeper flexors of the toes affording the broad shiny intermuscular septum upon which each group may separately move.

We have in the leg set apart by the subdivisions of the deep fascia, four groups of muscles. The extensor group with its anterior crural nerve; the peroneal with its musculo-cutaneous nerve; the flexor pedis group with the internal popliteal nerve; and the flexor digitorum group with its posterior tibial nerve.

Upon the arm the Pectoralis Major is separated from the Minor beneath by the interpectoral leaflet for similar reasons. The costo-coracoid membrane has a protective function.

In the axilla notice that the arrangement of the deep fascia is most ingenious. For while in the intergluteal fold and in the fold of the groin and the inner side of the thigh there are contiguous bones for immediate attachment, the arm pit is deeper than either of these, and in order to keep its peculiar shape and also to preserve the tucking up of the space, the dome of the axilla projects upwards to join the costo-coracoid membrane which projects from this dome-like involution to be subsequently attached above to the clavicle. In this way the folds of the axilla are kept taut, so that we can approximate the arm to the side of the chest without wrinkling or catching the structures; and the skin of the pit is supplied with hair to prevent friction and excoriation from moisture. Upon the arm itself we have a subdivision into flexor, extensor and supinator groups outlined by the fascia; in fact is not the development of fascia here an advance in the scale of function? was not the forearm covered with a single sheath of muscular fiber which by a variety of changes has become the association of muscle and fascia found at the present time?

The Biceps Cubiti as a flexor of the forearm might be in a sheath with the Brachialis Anticus; but as a supinator of the forearm and from its action upon the scapula, it needs a smooth incapsulation separate from the contiguous muscles. In the forearm the anterior muscles are usually divided into a superficial and a deep group. I prefer to divide them for purposes of descriptive and surgical anatomy into three groups, (1) the Flexor Carpi Radialis, the Palmaris Longus, the Flexor Carpi Ulnaris, the Pronator Radii Teres, being the first. (2) The Flexor Sublimis Digitorum. (3) Upon the interosseous membrane, the Flexor Profundus Digitorum, the Flexor Longus Pollicis and the Pronator Quadratus. The (2) Flexor Sublimis Digitorum is the only one upon the forearm having attachments to all three bones, radius, ulna, and humerus. It is therefore, in addition to its digital use, in part a flexor of the forearm and has a separate sheath from the muscle above and below.

The central compartments of hand and foot divided off by the septa from the deep fascia again indicate an obviously distinct instrumentality, which is so in fact because it contains the long tendons going to the smaller fingers or toes and having primarily an action upon the phalanges at the beginning of the contraction, but later upon the hand or foot as a whole. In the cervical region allow me to mention that there are anteriorly three main subdivisions of the deep fascia, (1) The anterior or investing layer attached to the spine of the scapula, the acromion, the clavicle and the sternum below, and to the mandible, mastoid process and superior curved line of the occiput above; forming the sheaths of the Sterno-mastoid and of the Sterno-hyoid and Sterno-thyroid muscles. (2) The pretracheal layer. (3) The prevertebral layer. Between the pretracheal and the prevertebral layers are the viscera of the neck, the thyroid gland, the trachea and the oesophagus. It has always seemed to me a wonderful provision, this firm layer of fascia in front and behind so that they should have in the exercise of their activity smooth surfaces upon which to move, with a separate compartment for their distinct use; it being particularly important for the oesophagus to expand easily in every direction. This broad, white, hard, smooth, prevertebral layer is admirably adapted for this purpose. I have pointed out elsewhere that it may also be utilized as a guide for the removal of cervical growths such as sarcomata, enlargements

of lymphatic glands or of the thyroid. The familiar observation that when we swallow, the larynx goes up taking with it the thyroid gland, as a diagnostic point between aneurism and goitre, is due to these three structures being in their separate compartment, while the extension of the pretracheal layer down to the pericardium explains "the tracheal tug" in aneurism of the arch of the aorta.

Arguing from analogy we might regard the dura mater as the deep fascia of the brain and cord, while had we time we might refer in detail to the canalization (*canalisées*) of the venous structures at the base of the neck, and the elasticity and spring of the hand and of the foot. My object has been mainly to direct the attention of the members of the Association to the great importance of the fascia as well as to the fact that we may well regard its distribution, separating the structures as an indication of a separation into distinct functions.

THE FACIAL EXPRESSION OF FATIGUE AND VIOLENT EFFORT.

[Abstract.]

BY DOCTOR R. TAIT MCKENZIE, MCGILL UNIVERSITY.

In fatigue, as observed in a foot race of a mile, we see the following changes: First, the lips are slightly parted, the teeth open, eyes semi-closed, brows contracted, as in mental concentration, the upper half of the orbicularis acting with the corrugator supercilii. The expression is that of alertness and attention, as seen in intent listening, combined with mental concentration.

As the race proceeds, the expression of respiratory distress appears, the lips are drawn down by the depressors and up by the levator proprius and zygomaticus minor. The corrugator acts strongly, giving an expression of suffering to the forehead, such as seen in pneumonia. As the respiratory need increases, the nostrils are dilated by the levator labii superioris alaeque nasi, which in acting, raises the lip, accentuating the expression of grief and carrying up the mass of the cheek tending to close the eyes. This expression of grief, even to crying, is typical.

Yet, further in the race this expression passes away and the

face becomes apathetic, the mouth gapes and the jaw drops, the upper eyelid tends to droop and the face assumes a drunken expression, such as is seen in some of Hogarth's drawings. The lowering of the upper lid is counteracted in one of two ways: either by throwing the head back, a movement which also assists in breathing and rests the muscles of the neck, or more often by bringing into action the occipito-frontalis. This gives rise to an expression of astonishment in the upper part of the face—seen also in Ptosis. This, with the lines of the mouth just described, gives a special expression that contradicts any of the ordinary, well-recognized emotions.

In extreme exhaustion or collapse we have a failure of the circulation, the jaw drops, the upper lid comes down, the face becomes expressionless and the man drops inert.

When a violent effort is made to fight this great fatigue, the expression entirely changes and comes more nearly to correspond to that pictured by Sir Charles Bell, as rage. The teeth are clenched and both lips retracted, as in a snarling dog; the nose is wrinkled transversely by the pyramidalis; the respiration is arrested and blood pressure increased; the eyes are almost closed to protect the vessels of the eyeball (as explained by Bell and quoted by Darwin).

In a dash of 100 yards the distance is covered without taking breath and the arms are violently used. Hence the chest walls are fixed and the glottis closed to give a firm base of support for the arms; this raises the blood pressure at once, hence there is seen in action the orbicularis pulpebrarum, levators of the lip and nose and the depressors of the mouth showing the clenched teeth. The result is the typical expression of rage closely approaching the drawing of this emotion by Sir Charles Bell.

The action of the platysma is interesting. It has been named by Duchenne the muscle of fear, but this is inadequate, for by its action fear becomes horror, pain torture, and surprise stupefaction. It might better be called the muscle of emphasis. In violent effort it is always put into powerful action, either to improve the respiration by opening the mouth, or it may be a relic of the old carnivorous habit of unsheathing the teeth. Certainly it completes in this part of the face the typical expression of rage, with an added element of grief, which gives the face an expression of impotent fury.

A NOTE ON THE RELATION OF THE EXTERNAL CAROTID ARTERY.

[Abstract.]

BY DR. WM. KEILLER, OF GALVESTON, TEXAS.

Text-book descriptions of the relation of the external carotid (with the exception of Cunningham's description in his "Dissector's Guide") are incorrect: (1) In describing the ramus of the jaw as an internal relation when it is really external. (2) The structures described in text-books as lying in front are really external. (3) The statements as to its relations to the parotid gland are misleading. (4) It is at first anterior, and slightly internal to the internal carotid, then winds backwards and outwards till it lies on its outer side. (5) Most of the structures described as lying behind it are internal.

NON-DEVELOPMENT OF THE LEFT HEART AND CLOSURE OF AORTIC VALVE, DEPENDING UPON AN ERROR IN THE DEVELOPMENT OF THE AURICULAR SEPTUM.

[Abstract.]

BY DR. JOS. A. BLAKE, NEW YORK CITY.

The child from which the specimen was taken lived four days. It presented no other abnormalities. It was cyanotic and died of cardiac failure. The right chambers of heart, the pulmonary artery and ductus arteriosus are very large. The left chambers are very small. The aortic opening is closed by a fibrous septum consisting of the fused valves. The ascending aorta is only of sufficient caliber to supply the coronary arteries. The eustachian valve is rudimentary.

The valve of the foramen ovale is developed in the right auricle so that fluids can only pass from the left to the right auricle. This arrangement of the valve can be explained by the method of development of the auricular septum, as described by Born in rabbit embryos, if we presume an overgrowth of the septum secundum and an insufficient development of the primary septum. The interest of the specimen lies in the generalization of the application of Born's theory of development. The left ventricle receiving no blood, the aortic valves were kept closed by back pressure and fused. No similar anomalies could be found recorded.

OBSERVATIONS ON SENSORY NERVE FIBERS IN THE VISCERAL NERVES, WITH REMARKS ON THEIR MODE OF TERMINATION.

[Abstract.]

BY DR. G. CARL HUBER, UNIVERSITY OF MICHIGAN.

That relatively large medullated nerves end in the viscera we know from the observations of Gaskell, Langley and Edgeworth, and from the more recent investigations of numerous observers who have investigated the sympathetic nervous system or the innervation of the viscera with the aid of the Golgi or methylin blue methods. That these relatively large medullated nerves terminate either in special end-organs, Pacinian corpuscles, encapsulated nerve-endings of Timofew, etc., or in free sensory endings, seems also well established. The writer proposes to draw attention more especially to the free sensory endings in viscera, and to emphasize the following points: (1) the repeated division of such sensory nerves before losing their medullary sheaths; (2) the relatively large number of arborizations in which such nerves terminate; and (3) the fact that they terminate in the mucosa and epithelium lining the hollow organs and ducts.

SENSORY NERVE TERMINATIONS IN THE TENDONS OF THE EXTRINSIC EYE MUSCLES OF THE CAT.

[Abstract.]

BY DR. HUBER.

Marchi, Ciaccio and Sherrington have shown that medullated nerve fibers terminate in the tendons of the extrinsic eye muscles of a number of mammals. These nerves are looked upon as sensory nerves, although, as Sherrington has shown, not branches of the ophthalmic division of the trigeminus. In the cat the nerves ending in the tendons of the extrinsic eye muscles do so in terminations which differ in structure from the neuro-tendinous endings found in other skeletal muscles of this animal. The medullary nerves which terminate in the eye muscles of the cat lose their medullary sheaths just before reaching their destination and end in a

network of varicose fibers, which network surrounds the tendon fasciculi just distal to the insertion of the muscle fibers. Each tendon fasciculus surrounded by such a plexus is enclosed within a thin, closely fitting, fibrous sheath.

THE ANATOMY OF THE ANAL REGION.

[Abstract.]

BY DR. KEILLER.

A careful description of the relations of the levator ani, external and internal sphincter, the radicles of the hemorrhoidal veins, and the bearing of these facts on operations for piles and on the pathology of ischio-rectal abscess.

THE NORMAL CAPACITY OF THE HUMAN BLADDER.

[Abstract.]

BY DR. F. H. GERRISH, PORTLAND, MAINE.

This question can be answered by physiologic tests only. The normal capacity is not shown by the amount of fluid which the viscus can possibly contain without rupture or even by that which it occasionally holds without appreciable harm. But it can be determined by ascertaining the average amount of urine secreted in 24 hours, and the average number of micturitions in the same time. By this method the capacity is found to be not much in excess of 250 grams (8 oz.): one-half that usually stated.

DR. SHEPHERD thought that Dr. Gerrish was correct in stating that the capacity of the bladder had been overestimated but he thought the amount a bladder could contain varied much in different individuals. He believed that the capacity of the bladder for containing a large quantity of urine depended on the opportunity the individual had for evacuating it. Persons of sedentary habits often could hold their urine for a long time. Hysterical women often had much over distended bladders and no harm resulted. The character of the urine often determined the frequency of micturition; if the urine was acid the bladder was emptied much oftener than if the urine was neutral. The capacity of

the bladder had been estimated by what it would hold on the dead subject, and varied, perhaps, not quite as much as that of the stomach.

THE DELIMITATION OF THE DIVISIONS OF THE LARGE INTESTINE ACCORDING TO INTRINSIC FEATURES.

[Abstract.]

BY DR. GERRISH.

The argument made is that the segment variously called sigmoid colon, sigmoid flexure, iliac colon, and omega flexure, should include all of that part and only that part of the large intestine, caudad of the crest of the ilium, which has a mesentery. This plan would subtract a little from the cephalic portion of the sigmoid colon, as generally accepted now, and would add to its caudal portion making the rectum begin at the third sacral vertebra.

DR. SHEPHERD said that Mr. Treves had long ago pointed out that the sigmoid flexure of the colon was really V-shaped and hung down into the pelvis. For his part he preferred some definite points limiting the different portions of the large bowel, and thought for purposes of surgical description this was necessary. If the mesentery were to be the limit, then the point of commencement of the rectum would differ in each individual.

COMMENTS UPON THE FIGURE OF THE MESAL (MEDIAN) ASPECT OF A HUMAN BRAIN AS PUB- LISHED BY HIS AND REPRODUCED BY HIM AND OTHERS.

[Abstract.]

BY DR. B. G. WILDER, CORNELL UNIVERSITY.

In the *Archiv für Anatomie* for 1893, Professor His published a figure of the mesal aspect of an adult human brain; it was reproduced on p. 76 of the protocols of the B. N. A., and in the B. N. A. itself, *Archiv für Anat.*, 1895, Suppl. Band., p. 161, but is there stated (evidently through inadvertence) to represent a fetal brain of the third month. The figure has been reproduced without comment by Van Gehuch-

ten (second edition) and L. F. Barker ("The Nervous System," 1899). Even if designed merely as a diagram in illustration of its author's views of the definitive segments, and even if many teachers and investigators are so well informed as not to be misled by its errors of omission and commission, certain features are certain to cause serious and wide-spread misapprehension. Twenty such features were specified. The most important exemplify the general defect of such figures in most manuals, viz: incomplete circumscription of the cavities, and inadequate demarcation of the cut surfaces from the natural (pial or endymal). In these respects anatomists may well imitate the accuracy of Reichert ("Der Bau des Menschlichen Gehirns," 1859-'61), although his figures are not absolutely perfect.

THE BASIS AND NATURE OF A SCHEMA OF THE DEFINITIVE ENCEPHALIC SEGMENTS.

[Abstract.]

BY DR. WILDER.

A satisfactory definition of "Definitive Encephalic Segment" has not yet been framed, but the best example is the Mesencephalon (crura and quadrigeminum). Although developed from one "vesicle," this apparently includes at least two of the "neuromeres or primitive segments." Many points are still undetermined. Some were discussed in 1897 in "What is the Morphologic Status of the Olfactory Portion of the Brain?" Others are indicated among the fifty "Questions as to the Segmental Constitution of the Brain"; copies of the seven mimeographed sheets bearing these "Questions" were distributed at the meeting and will be sent to those interested. The following conclusions are regarded as sound:—The provisional schema of the definitive segments should be based upon adult rather than developmental conditions. The definitive segments need not be structurally or developmentally identical. They need not coincide with either, (a) the primitive neuromeres, or (b) the primary encephalic vesicles, or (c) the secondary vesicles. No species or group should be ignored. The presumption is in favor of generalized forms, and not in favor of forms merely because they are available for other purposes. When both naturalness and convenience are taken into account, the best

provisional schema corresponds mainly with the one indicated in the table on p. 29 of the Proceedings of this Association for May, 1897.

PROFESSOR HERRICK asked for a definition of the term "segments" as used by the speaker, particularly their relations to the neuromeres of the embryologists and the metamerism of the head in general—in short, what are the real morphological criteria and relations of these structures?

DR. WILDER replied that, as intimated at the beginning of his paper, he had no satisfactory definition to offer. He used the term "definitive segment" to designate a region of the brain that is both convenient and natural although not necessarily homologous in all respects with any other region. Excepting that the olfactory region is recognized as a definitive segment the regions correspond essentially with the five "vesicles" described by von Baer in 1837, and with the five "fundamental parts" recognized in the seventh edition of Quain." Strictly speaking, "segment" is no more appropriate to these divisions than it is to the thorax or abdomen of an insect, but rather than coin a new term he had simply prefixed the word "definitive".

IS NEURON AVAILABLE AS A DESIGNATION OF THE CENTRAL NERVOUS SYSTEM?

[Abstract.]

BY DR. WILDER.

"Neuron" (from *νευρον*) was proposed by me in this sense in 1884 (*N. Y. Med. Jour.*, Aug. 2, p. 114), and employed in the same Journal, March 28, 1885, p. 356; in addresses before the Amer. Neurol. Assoc. (*Jour. Nerv. and Ment. Dis.*, July, 1885); *Amer. Asso. Adv. Sci. Proceedings*, 1885, and in the second edition of "Anatomical Technology," 1886. It has been adopted by McClure, Minot, Waters and others. The reasons for its abandonment in 1889 for *neuraxis*, as stated in the Proceedings of this Association for 1895, p. 44, and Ref. Handbook of Med. Sci., IX., 100, now seem to me inadequate. *Neuron* is the basis of *neural* (as applied to aspect, folds, furrow, and canal) and of *neurenteric* and other compounds, and it is the natural correlative of *enteron* (entire alimentary

canal) and of *axon* (notochord or primitive skeletal axis). Not until 1891 did Waldeyer propose *neuron* for the nerve-cell and its processes; not until 1893 did Shafer apply it to the axis-cylinder process. As with *tarsus* and *cilium* the context would commonly avert confusion between the macroscopic and microscopic significations of the word in a given case. The compounds *macroneuron* and *microneuron* might be employed if necessary, or (as suggested by L. F. Barker) the histologic element might be designated by *neurone*, as if from *νεῦρον*. Note.—The question is now further complicated by Van Gehuchten's adoption of "Neuraxe" as the title of a new journal of neurology.

POLY- AND SYNDACTYLISM.

[Abstract.]

BY DR. SHEPHERD OF MONTREAL.

Dr. Shepherd showed a series of skiagrams and photographs illustrating some of the deformities of the digits with which he had met. The first case was that of a young man, aged 21, who had six digits on each foot and hand, and they were so arranged that the deformity was not noticed unless attention was especially attracted to it; there was a gradual diminution in size from the middle finger to the supernumerary little digit (*post minimus*). His paternal greatgrandfather had supernumerary digits, as had a paternal uncle, and this uncle's children had supernumerary digits. Two of his own brothers and two of his sisters had a like condition, as well as his sister's and brother's children. In another case also there was a hereditary history for some generations on the father's side. Another case was stated and the photographs shown where, in a man aged 22, there was no thumb on the left hand and only a very rudimentary one on the right hand; no history of heredity. Another, where there was absence of the thumb of right hand and a rudimentary little finger with absence of the fifth metacarpal bone. The father had a similar deformity. A remarkable skiagram was exhibited which showed a fusion anteriorly of the proximal phalanges of the middle and ring fingers, and a complete fusion of the middle and distal phalanges of these fingers; also a case of fusion of the ring and middle fingers of the right hand in a

boy, aged 20. In neither case was there any history of heredity. In polydactylism, Dr. Shepherd thought some cases might be due to reversion, but the majority he thought were probably the result of dichotomy.

IF AN "ISTHMUS RHOMBENCEPHALI" WHY NOT
AN "ISTHMUS PROSENCEPHALI"?

[Abstract.]

BY DR. B. B. STROUD, CORNELL UNIVERSITY.

In the early fetal brain of man, the cat, and perhaps some other mammals, there is a necklike region just caudad of the mesencephal. Professor Wilhelm His names this region "Isthmus Rhombencephali," and apparently regards it as coördinate with the other five definitive segments recognized by him (*Archiv für Anatomie*, 1893, 173-174; 1895, Suppl. Bd. "B.N.A.," 157). The following passage is on p. 173 of the *Archiv* for 1893: "Das Gebiet der Bindearme bedarf einer selbstständigeren Berücksichtigung, als sie ihm gewöhnlich zu theil wird, und ich führe dasselbe unter dem Namen des Isthmus Rhombencephali als besonderen Abschnitt des Rautenhirns auf." But in these same specimens, and in many of the figures published by His in the *Archiv* for 1892 and 1893, in the "Anatomie menschlicher Embryonen," 1880, and in "Die Entwicklung des menschlichen Rautenhirns," 1891, there is another necklike region cephalad of the mesencephal quite as distinct and sometimes more so. A schema of encephalic segmentation should be consistent, and while not denying the possibility that one or both of these regions may represent a primitive neuromere, it seems reasonable to conclude that, taking into account the adult and developmental conditions in vertebrates generally, probably neither should be regarded as a definitive segment. The paper was illustrated by charts, photographs and drawings, one of which is reproduced in Fig. 1.

PROFESSOR HERRICK inquired whether the segments or regions enumerated in Professor His' table were designed to be regarded as strictly coördinate morphological units, *i. e.*, structures of equal morphological value.

DR. WILDER (by whom the paper was read in the absence of Dr. Stroud) replied that in the semidiagrammatic figures of Professor His, the segments are represented of various ex-

tents and the "Isthmus" always the shortest. But the text of his papers and of the B. N. A. seems to assign equal morphologic value to each of the six regions recognized by him, and in the "Tables" (pp. 158-162) the spacing and typography permit the same interpretation.

Dr. Wilder added that Dr. Stroud should have credit for the independent formulation of the logical question, but that, as a matter of both history and confirmation, he would like to record that among the typewritten but unpublished notes that accumulated in the fall of 1897, during the preparation of his paper, "What is the morphologic status of the olfactory portion of the brain?", the following query had been found:

"If the short constricted region between the human cerebellum and the quadrigeminum is to be recognized as a definitive segment, why not also the constricted region between the quadrigeminum and the thalami (including, perhaps, the 'Recessus geniculi') which is distinctly represented in Figs. 17, 18 and 19 of the B. N. A.? Why not still more the much longer, slender region in *Chimaera* connecting the expanded portions of the diencephal and the prosencephal?"

CEPHALIC NECK.

"ISTHMUS"

METATELA.



FIG. 1.

Figure 1 is the reproduction of a photograph of a human fetus 22 mm. long; No. 2,652 Museum of Cornell University. It is of about the same age, eight weeks, as His' embryo "Figure 5, p. 13, *Die Entwicklung des menschlichen Rautenhirns*, etc., 1891." It shows the great prominence of the mesencephal and its extension both cephalad and caudad. The cephalic neck is more distinct than the "isthmus." Transitory fissures are present in both the cerebrum and the mesencephal.

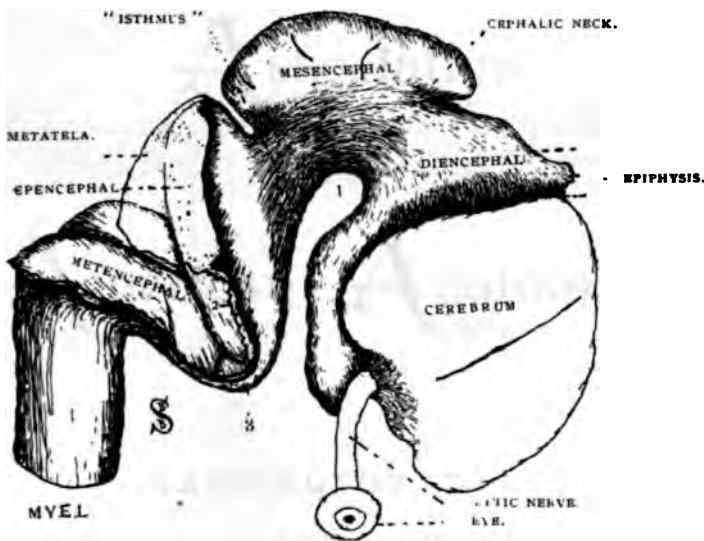


FIG. 2.

Figure 2 is the brain of the same fetus shown in Figure 1, enlarged seven diameters. It shows the same features on a larger scale and the general appearance of the brain at this period of development.

1. Cranial flexure.
2. Torn edge of the metatela.
3. Pons flexure.

PROCEEDINGS
OF THE
THIRTEENTH SESSION
OF THE
Association
of
American Anatomists,
HELD IN
WASHINGTON, D. C.,
MAY 1 AND 2, 1900.

WASHINGTON, D. C.,
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PROCEEDINGS OF THE THIRTEENTH SESSION.

The thirteenth session of the Association of American Anatomists (meeting as a constituent society of the Fifth Congress of American Physicians and Surgeons), was held in the ladies' parlor of the Normandie Hotel, corner Fifteenth and I Streets, N. W., Washington, D. C., Tuesday and Wednesday, May 1 and 2, 1900. Nineteen members were present at some time during the meeting, namely: Bevan, Browning, Dodson, Gerrish, Hewson, Huntington, Kerr, Lamb, Martin, Miller, Minot, Mixter, Reisinger, Shepherd, Shufeldt, Shute, Terry, Thompson and Wilder.

TUESDAY, MAY 1.

At 10 A. M. the Association was called to order by the President, Dr. Huntington. The Executive Committee, by Dr. Shepherd, Chairman, recommended for membership Dr. Millard F. Thompson, Professor of Anatomy, National University Medical College, Washington, D. C. Also the following amendment to Article 8 of the Constitution; to substitute for the first sentence the following: "Candidates for membership must be persons engaged in teaching or investigation in the Anatomical Sciences and be proposed in writing to the Executive Committee by two members." The report was accepted, Dr. Thompson elected, and the second recommendation adopted.

The Secretary and Treasurer, Dr. Lamb, made a provisional report, in view of the fact that an annual report would be required in December. The following are extracts:

The receipts since last meeting have been \$368.75 from dues, and \$15.90 from subscriptions to the *Journal of Anatomy and Physiology*. The expenditures were as follows: Printing,

\$20.05; subscriptions to the *Journal of Anatomy and Physiology*, \$15.33; share of expenses of New Haven meeting, \$2.00; Secretary's expenses at same meeting, \$14.19; stationery and postage, \$7.46; telegrams, typewriting, copying and express, \$8.33; due Treasurer for moneys advanced, \$83.36; total, \$153.72. Balance in hand, \$230.93.

At the last meeting there were 125 active and 9 honorary members; total, 134. Six new members were elected, making the number 140. Since then 7 have resigned (Dr. H. S. Birkett, Medical Department, McGill University, Montreal; Dr. P. A. Fish, Cornell University; Dr. Thomas Flavin, Medical Department, University Texas; Mr. F. A. Lucas, U. S. National Museum, Washington, D. C.; Dr. J. B. Roberts, Philadelphia Polyclinic, &c.; Dr. W. H. Rockwell, Medical Department, Columbia University, New York City; Dr. T. B. Stowell, State Normal Training School, Potsdam, N. Y.), and five have been dropped for non-payment of dues, (Drs. Forbes, Gregory, Hodge, Hunt and Lee). At present there are 128 members—118 active, and 10 honorary.

The Secretary recommended that he be authorized to print and publish the proceedings of the last and present sessions under one cover and as one pamphlet, to save expense.

The report was accepted and recommendation adopted.

There was no report from the Delegate or Alternate to the Executive Committee of the Congress.

The following papers were read:

1. "A method of sectioning the whole decalcified body with a knife." By Dr. Terry, of St. Louis. Illustrated by specimens. Discussed by Drs. Lamb, Dodson, Wilder and Minot.
2. "A new head-rest for use in removal of the brain." By Dr. Stroud, of Cornell University. Exhibited by Dr. Wilder in Dr. Stroud's absence. Discussed by Drs. Lamb, Hewson and Miller.
3. "Panchoroidea or the primitive vascular tunic of vertebrates." By Dr. Minot, of Boston. Discussed by Drs. Wilder, Huntington and Dodson.
4. "The mesothelial villi of the allantois." By Dr. Minot.
5. "Preservation of anatomical material at the University

of Buffalo." By Dr. Kerr, of Buffalo. Discussed by Drs. Hewson, Dodson, Terry, Lamb, Huntington, Wilder and Shepherd.

6. "Morphological significance of certain aberrant muscles of the pectoral girdle." By Dr. Huntington. Discussed by Dr. Wilder.

The Association then adjourned until next morning.

At 2.45 P. M. the Congress began its session at the Lafayette Square Opera House.

WEDNESDAY, MAY 2.

The Association reassembled at 9.30 A. M. The Executive Committee reported through Dr. Lamb the name of Dr. Robert Reyburn, formerly a member of the Association, recommending him for renewal of membership. Report accepted and adopted.

The following papers were read :

7. "Further tabulations and interpretations of the paroccipital fissures." By Dr. Wilder. Illustrated by charts, photographs, etc. Discussed by Drs. Lamb and Huntington.

8. "The form and relations of the spleen studied by hardening it *in situ* with formaldehyde." By Dr. Martin, of New York city. Illustrated by specimens. Discussed by Drs. Hewson, Terry, Lamb and Minot.

9. "Revised schema of the cerebral fissures." By Dr. Wilder. Illustrated by charts, photographs, &c. Discussed by Drs. Hewson, Terry, Lamb and Huntington.

The following papers were read by title :

10. "History of the Anseres." By Dr. Shufeldt, U. S. Army, retired.

11. "The anatomy of the renal vessels in relation to digital exploration of the pelvis of the kidney." By Dr. Keiller, of Galveston, Texas.

12. "Some surgical and anatomical points in reference to the gall-bladder and biliary passages." By Dr. Brewer, of New York city.

The Committee on Anatomical Nomenclature, by Dr. Wilder, Secretary, reported upon the list of anatomical terms which the committee had presented at the previous session. [See Proceedings Twelfth Session, pages 7 and 8.] The report was accepted and the recommendation of the Committee adopted as the recommendation of the Association. The list as recommended is as follows :

Nervi cerebrales vel craniales.

- Nervi olfactorii,
- Nervus opticus,
 - " oculomotorius,
 - " trochlearis,
 - " trigeminus vel trifacialis. [Consideration postponed.]
- Nervus ophthalmicus,
 - " maxillaris,
 - " mandibularis,
- Nervus abducens,
- " facialis,
- " acusticus vel auditorius. [Consideration postponed.]
- " glossopharyngeus,
- " vagus,
- " **accessorius,**
- " **hypoglossus.**

Nervi spinales.

- Nervi cervicales,
- Plexus brachialis,
- Nervus musculocutaneus,
 - " medianus,
 - " ulnaris,
 - " radialis.
- Nervi thoracales,
- " lumbales,
- " sacrales,
- Nervus coccygeus,
- Plexus lumbalis,
- " sacralis,
- Nervus iliohypogastricus,
- " ilioinguinalis,
- " genitofemoralis,
- " obturatorius,
- " femoralis,
- " sciaticus.

Systema nervorum sympathicum.

Truncus sympathicus,
Ganglia trunci sympathici,
Plexus sympathici,
Ganglia plexuum sympathicorum.

The Association then adjourned *sine die*.

At 2.45 P. M. the Congress held a second meeting. At 8 P. M. the President of the Congress, Prof. Henry P. Bowditch, of Boston, delivered his presidential address. At 9.30 P. M. a reception was given at the Arlington Hotel by the President and other officers of the Congress, and on the evening of May 3d a banquet was given at the same place by subscribing members to invited guests.

A METHOD OF SECTIONING THE WHOLE DECALCIFIED BODY WITH A KNIFE.

R. J. TERRY, M. D., ST. LOUIS, MO.

The application of a decalcifying agent to the whole body for the purpose of so softening the bones that sections could be cut with a knife, suggested itself after I had seen some head specimens prepared by my friend Dr. Sluder. He told me that while studying the nasal region he found it necessary to have sections of the head made in some way other than by freezing and sawing, since this method would not give the results he wished; and in trying to devise some more suitable procedure hit upon the decalcifying process. We are all familiar with the fact that decalcifying methods are used in histological laboratories, and it is well known that the same means is resorted to to facilitate the gross dissection of certain parts of the body. Whether any one has decalcified the whole human skeleton *in situ* I am at present unable to say, but all inquiries into the matter have been met with negative answers.

Let me take this opportunity of telling my experience in the work, crude as it now is, with the hope of seeing the process developed into a useful one by the aid of those interested enough to try it.

Briefly outlined: the method consists in a thorough fixing and hardening of the tissues followed by saturation of the body with a diluted acid; after a time the bones are found soft enough to be easily cut with a knife.

For the preparation of small parts, such, for example, as a hand, it is not necessary to inject either the hardening agent or the acid; but injection, coupled with immersion, hastens the process. I have found for this work that formaline by itself or with alcohol is better for hardening the tissues than is alcohol alone, and immersion in a 10 per cent. solution for a period varying with the size of the part is quite satisfactory.

When the piece has been thoroughly hardened it is to be placed in a jar and covered with a mixture of HCl 1 part and 1000 parts. From time to time the hardness of the bones should be tested with a fine awl, care being taken not to in-

jure the larger vessels. Five or six weeks, or even longer, is necessary for the complete decalcification of a hand.

There are some precautions which must be observed in the treatment of the whole body.

It is necessary to examine the surface carefully for punctures, such as undertakers make with their canulæ in the walls of the belly and chest, or for small gun-shot wounds. If these exist the body is unfit for decalcification.

A bandage should be evenly wrapped about the head, neck, chest and abdomen, in order that the fluids which are to be injected shall be uniformly distributed; for with injections of watery fluids into the vessels there is a tendency to fill the belly and chest to the almost complete exclusion of the limbs. The femoral artery on one side has been selected as the place for injecting the preserving and hardening fluid, which for the whole body has been a mixture of equal parts of formaline and 95 per cent. alcohol. Five or six quarts of this were sent into the artery by an air pressure of 10 pounds.

While the fluid is running into the subject the head and limbs should be put in proper position and means provided to keep them so; the lips and eyelids should have been closed before the bandage was applied.

The subject is to remain undisturbed for two weeks, and at the end of that time the arms and thighs, for convenience, should be amputated a short distance from the trunk, and placed at once in the acid bath.

Turning our attention now to the trunk, the first thing to be done before beginning to decalcify it, is to find and tie all vessels in the stumps, leaving one femoral artery, however, for the insertion of a canula.

The body, still bandaged, should next be placed head downward in some vessel which will not be attacked by the acid. The same proportion of acid to water is used for the trunk as for small parts, but the subject should be injected with it as well as immersed in it. The injection should be done at least twice a day, adding more acid to the fluid as it becomes weaker.

When the mandible and the upper part of the femur can be punctured with a fine awl the body can be sectioned, for, I have found, these are the last parts to yield to the acid.

About ten weeks are required to bring about complete decalcification.

Up to the present time no attempt has been made to embed the trunk in a thorough way ; I expect to undertake this with a subject now decalcifying.

The first body which was sectioned by me was embedded in a stiff glycerine jelly, and while this maintained the trunk in a fairly steady position, yet the jelly was difficult to cut and caused no little trouble on that account. The sensation experienced while carrying the knife through the softened bones is like that of cutting leather. Sometimes a hard spot is encountered, but not often ; it emphasizes the necessity of prolonged soaking in the acid. When freshly cut the sections showed no distortion or unequal shrinkage of organs or body walls ; there was no disintegration of the soft parts and the bones and cartilages alike were unchanged in size and shape.

But after all, it will be asked : "What is gained by this method?" For making thick sections I should prefer to freeze and saw the body ; but for thin sections or for complete serial sectioning of a part of the body, or of the whole body, the saw is not as good as the knife blade. The saw, however fine it may be, wastes something ; there is saw-dust. So I believe that with improvements in the mode of fixing and hardening the tissues, and with a proper means for embedding the subject, this method of section-cutting will be found useful in the reconstruction of regions, particularly for the study of the relations of organs to the body walls. Sections for such a purpose need not be of the thinness demanded for microscopic work ; perhaps a thickness of 2 mm. would be found suitable in the reconstruction of most regions intended for naked-eye study. A few sections not thicker than this have already been cut, without embedding.

A NEW HEAD-REST FOR THE REMOVAL OF THE HUMAN BRAIN.

BY DR. B. B. STROUD, CORNELL UNIVERSITY.

This apparatus was devised for the purpose of holding the head firmly with the base of the cranium horizontal. This enables the base of the skull to serve as a shallow tray in which the brain is supported during its removal. The subject lies upon the belly, being supported by adjustable clamps fitting

into the auditory meatuses, and the head naturally assumes a position in which the long axis of the cerebrum is nearly horizontal. Repeated trials in the neurologic laboratory at Cornell University this spring have shown that, with a maximum of convenience to the operator, there is a minimum of danger of rupturing the cranial nerves and certain delicate structures of the brain itself, which are frequently torn when the usual methods are employed. Fig. 1 shows a general view of the apparatus as adjusted for use. The remaining figures show details of construction.



FIG. 1.

The device consists of a base-board *A* to which is attached at right angles a second board *B*. Both are of $\frac{7}{8}$ -inch oak. Professor Wilder suggested that the upright board should be hinged to the base for convenience in storage and transportation. This is a very valuable improvement.



FIG. 2.

The upright *B*, Figs. 1 and 2, has a middle emargination and the sides are cut at an angle as shown in Fig. 2. The chin-rest *D* is hollowed upon the top to fit the chin. It slides in a shallow groove 0.5 cm. ($\frac{1}{4}$ inch) deep, cut in *B*, and is adjustable by means of the thumbscrew. The two lateral bars *E* are of iron. They project 3.5 cm. ($1\frac{1}{4}$ inches) above the board *B*, and serve to support the two jaws *F* and *G*.



FIG. 3.

The two clamps for grasping the head, Fig. 1, shown in detail in Fig. 3, consist of the jaw *F*, the guides *I*, and the screw *J*, which pierces *F* in the form of a spike *H*, 2 cm. ($\frac{3}{4}$ inch) long, to enter the auditory meatus. A flat head *J*, Fig. 3, is more convenient for turning the screw than the round milled head shown in Fig. 1. The jaw *F* is bent flat ways to fit the curve of the skull and grasp it dorsad of (posterior to) the mastoid process. The other end is curved downward, to fit under the zygoma and thus hold the head more firmly. The guides *I* are made from one piece of steel bent in the form of a rectangle and made to fit very closely to the top of the side iron *E*. They and the curved form of *F* prevent a disagreeable rocking motion of the head. *F* is firmly riveted to *I* by

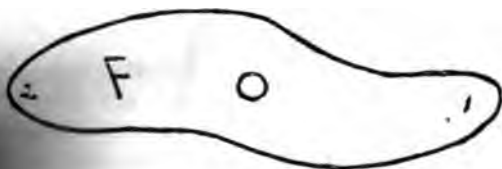


FIG. 4.

means of four double-headed rivets. The upright *B* is held in position by the two hooks *K* and *L*.

Fig. 4 shows the improved form for the jaw *F*, Figures 1 and 3.

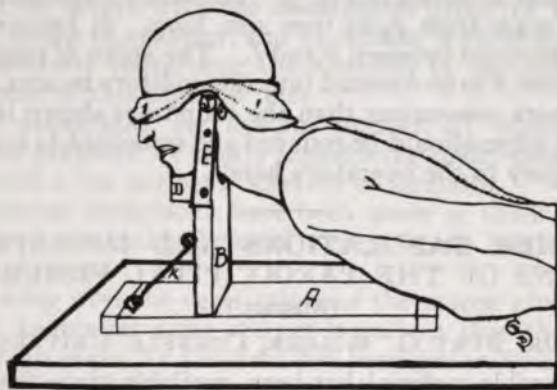


FIG. 5.

Fig. 5 shows the apparatus in use. The scalp is divided by a single cut made from the root of one ear and carried over the vertex to a corresponding point at the opposite ear. The calva is removed, after the method of Professor Wilder, in two pieces. A circular kerf is sawn around the cranium 1 cm. above the orbit and the occipital protuberance. A second kerf is made sagittally 1 cm. to the left of the meson. 1, 1, are the reflected portions of the scalp. The calva is exposed and ready for sawing.

SPECIFICATIONS.—*A* and *B* are made of $\frac{7}{8}$ -in. oak. *A* is 30 x 40 cm. (12 x 18 in.) *B* is 30 x 26 cm. (12 x 10 $\frac{1}{4}$ in.) It is cut as indicated in Fig. 2. The middle cut is 15 x 13 cm. (6 x 5 in.) The front side contains a groove $\frac{1}{8}$ in. deep and 3 $\frac{5}{8}$ in. wide to receive the chin support *D*. *D* is of oak 5 x 9 x 17 cm. (2 x 3 $\frac{1}{2}$ x 6 $\frac{3}{4}$ in.) The top is hollowed out to fit the chin 4.5 cm. One and seven-eighths in. from the top it is cut down so as to be only $\frac{1}{2}$ in. thick. There is a slot in the middle to accommodate a set screw for fastening it at different heights. *E* is an iron bar, 17 x 2 x 1 cm. (6 $\frac{3}{4}$ x $\frac{3}{4}$ x $\frac{3}{8}$ in.) and is bent at a point 3.5 cm. (1 $\frac{1}{2}$ in.) from the top so as to be perpendicular to the base *A*. *F* is of $\frac{3}{16}$ in. steel, 9 x 3 cm. (3 $\frac{1}{4}$ x 1 $\frac{1}{4}$ in.) and formed as shown in Figs. 3 and

4; 1 is the front end shaped so as to fit under the zygoma; 2 is the rear end and grasps the temporo-occipital bone dorsad of the mastoid process.

The clamps *I* are made of $\frac{3}{8}$ -in. steel 12 x 2.5 cm. ($4\frac{3}{4}$ x 1 in.) and bent as shown in Fig. 3. The screw *J* operates the jaw *F*. It is made from $\frac{5}{16}$ -in. iron 4 in. long. It has a shoulder which is received between *F* and *I*. The spike *H* projects one inch beyond *F* to be inserted into the auditory meatus. A flat head is more convenient than the round one shown in Fig. 1. All sharp edges should be rounded and smoothed to avoid accidental injury to the operator's hands.

FURTHER TABULATIONS AND INTERPRETATIONS OF THE PAROCCIPITAL FISSURES.

[Abstract.]

BY DR. BURT G. WILDER, CORNELL UNIVERSITY.

Considerable material has been available since the reading of papers on the subject before this Association in 1895 (*Proceedings*, pp. 69, 70) and before the Amer. Neurological Association in 1896 (*Transactions*, pp. 37, 38). The general conclusions there expressed have been confirmed, but there have arisen questions, the solution of which requires both additional facts and the determination of the value to be assigned to those and other facts. For example, how do the paroccipital and parietal fissures develop in the other Primates? In the primary grouping of the relations of these two fissures should not a case in which submergence of the vadium is less than half the greatest depth of either of the two fissures be regarded as one of independence rather than of continuity? The use of the plural in the title of this paper is intended to indicate the writer's belief that the right and left paroccipitals are commonly so asymmetric as to require different representations upon any fissural schema.

THE FORM AND RELATIONS OF THE SPLEEN STUDIED BY HARDENING THE VISCUS *IN SITU* BY FORMALIN.

BY WALTON MARTIN, PH. B., M. D., NEW YORK CITY.

For the past three years as a part of the instruction given by the professor of anatomy at Columbia University dissec-

tions showing the viscera hardened *in situ* by formalin have been exhibited.

In examining and demonstrating these preparations it has seemed to me that the relations and form of certain viscera were not in accord with the descriptions given in the standard text books of anatomy, and to certain of these differences, more especially concerning the anatomy of the spleen, it is the purpose of this paper to refer.

These dissections are five in number, all adults. They have been prepared by slowly introducing under pressure into the carotids a ten per cent. solution of formalin.

In addition dissections have been made in three advanced fetuses and one child, the solid viscera being hardened by a similar solution.

In looking over the descriptions of the spleen given by the different anatomies since 1863 it is evident that the account of the organ given by Luschka has been generally adopted.

Luschka states that although the form is variable, two distinct types can be made out. In one the circumference of the organ is that of an irregular quadrilateral figure, in the other the outline is that of an oval. The first form he considers the more frequent. He then describes the viscus in detail and its relations, naming the three surfaces presented by the organ, renal, gastric and phrenic. The second form mentioned—the oval spleen—is referred to by His in his classic paper, published in 1878, describing the form and relations of the viscera hardened *in situ* by a 1 per cent. solution of chromic acid. The plates accompanying the text and the models made after the hardened structures show an oval spleen.

In 1895 Prof. Cunningham, of Dublin, came to the conclusion that His's models of the spleen did not represent the usual form of that organ, and published a paper to that effect.

He had constructed a model by freezing a body, cutting it in sections, hardening the segments, removing them piece by piece and reconstructing, allowance being made for tissue lost in cutting the sections. He confirmed his results by examining the spleens removed from two bodies hardened by Müller's fluid and by the form of the organ presented by two advanced fetuses hardened by a saturated solution of chloride of zinc, prepared by his assistant, Mr. Dixon.

A specimen hardened *in situ* by chromic acid solution is

stated by Birmingham to have presented a precisely similar form.

In the last American edition of Gray's Anatomy, plates taken from His's models are introduced. In Quain's Anatomy the plate of the spleen itself is taken from a model prepared from a fetal specimen by Mr. Dixon, and the relations of the organ are shown by drawings taken from His's models. The description is based mainly upon Cunningham's.

If one examines the plate taken from His's model of the structures lying behind the stomach covered by the peritoneum of the lesser sac, the following arrangement of the viscera is clearly shown. The pancreas stretches transversely across the abdomen, its tail abutting against the spleen. Above the pancreas are seen the upper portion of the left kidney and the left suprarenal. To the left of the kidney is the concave gastric surface of the spleen, only the hilum of this organ being in contact with the lesser sac. In three of the eight bodies examined an arrangement of the parts similar to that just described was found.

In the six remaining subjects, the viscera had a somewhat different arrangement. (Exhibition of a drawing from one of the dissections.) The appearance of the ventral surface of the pancreas was the same as in the plate of the His model. The gastric surface of the spleen was the same, but a distinct prominence of this organ is plainly visible just above the pancreas behind the peritoneum of the lesser sac, to the right of the hilum, hiding, for the most part, the left kidney (in the fetuses the left suprarenal). This prominence at first suggests the upper portion of the kidney as seen in the His model. Removing the dorsal layer of the lesser sac and dissecting out the large splenic vessels which pass in a curved course along the upper border of the pancreas, the nature of this protuberance and its relation to the kidney is made evident.

It projects from the intermediate border of the spleen immediately above that part of the organ in contact with the pancreas. If now the vessels be removed, a small area of the left kidney does appear. It is, however, on a distinctly different level, and when covered by the large splenic vessels and the fat and areolar tissue about them, is not in direct contact with the dorsal layer of the lesser sac. Finally, if the spleen be taken out it shows the following form: (Exhibition of plaster casts of spleens and hardened fetal spleens.)

The concave gastric, the convex phrenic and the flat renal surfaces have the shape and relations usually described: A triangular basal surface looking inward is in contact with the tail of the pancreas, and below this with the splenic flexure of the colon. This portion of the large intestine occupies the angle formed by the pancreas and the spleen.

A blunt dorsal border separates the phrenic and renal surfaces, a notched anterior border divides the gastric from the phrenic surfaces, and an intermediate border lies between the gastric and renal surfaces. This intermediate border is very prominent, forming a distinct tubercle, which, since it is in contact with the dorsal surface of the stomach, may be termed the *gastric tubercle*. A vein and an artery given off from the splenic vessels one inch or more from their termination pass over this tubercle to the upper portion of the hilum.

The posterior layer of the lesser sac covers this gastric tubercle and adheres to the peritoneum of the greater sac which invests this portion of the spleen, even in the fetuses examined. If the pancreas be divided about one inch from its splenic end, this portion, including the tail, can readily be removed with the spleen and the relation of these structures studied. The tail of the pancreas, blunt, somewhat irregular and of considerable extent, is slightly adherent to a triangular surface of the spleen just below the gastric tubercle, so that the lower edge of which touches the upper border of the tail of the pancreas.

In removing the spleen in most of the bodies examined adhesions existed between the peritoneum covering the kidney and that covering the spleen.

In conclusion, I wish to call attention to the following points:

(1) There is a distinct projection derived from the intermediate border of the spleen covered by the peritoneum of the lesser sac lying to the right of the hilum.

(2) The left kidney is not visible behind the stomach above the pancreas, being hidden by this prominent *gastric tubercle* of the spleen, by the large splenic vessels, by fat and areolar tissue, and being on a distinctly deeper level.

(3) The tail of the pancreas occupies a considerable triangular area on the spleen just beneath this tubercle.

(4) Therefore the so-called lieno-renal ligament cannot in most cases be demonstrated, and the representation of the

peritoneal relations at the hilum by two oval figures, one inside the other, the outer being the line of reflexion of the greater, the inner the line of reflexion of the lesser sac, cannot be verified in the hardened organ.

That a soft and plastic organ like the spleen, which physiologically changes its volume so frequently and which is enlarged in such a variety of conditions, should have constant relations and a fixed form is, of course, improbable; the correct idea undoubtedly being that of an easily moulded body thrust in between the liver, the diaphragm and the stomach and changing its shape with the varying degree of gastric distention, with the position of the diaphragm and the amount of blood in the organ itself.

However, the appearances presented by this viscus, hardened *in situ* by formalin, and its relations to adjacent structures, are more constant, I think, than one would expect.

REVISED SCHEMA OF THE CEREBRAL FISSURES.

[Abstract.]

BY DR. WILDER.

The paper contains commentaries upon the fissural diagrams published by Ecker (1869), Eberstaller (1890) and the writer (1886 and 1889). None is regarded as satisfactory, but the efforts to formulate such schemas should not be abated. Without disparagement to what has been done, there are still needed monographs of every fissure in its relation to adjoining fissures and in comparison with the supposed representatives in other Primates. One difficulty not commonly recognized lies in the necessity of representing fissures as either independent or continuous with others before it is possible to decide whether independence or continuity is the rule. This decision itself requires the determination of the existence and significance of vadum or concealed isthmuses, which are often ignored and difficult to observe. Also there must be taken into account cases of usual asymetry, like that of the paroccipital. It may be necessary to adopt one very general schema including only the constant fissures and relations, and to recognize several subordinate schemas representing as many fairly definable types such as Cunningham has framed for the intraparietal.

DR. LAMB, of Washington, called attention to the fact that many lower animals with powerful muscular development have smooth cerebra, so that it was a question how far the muscularity was related to fissuration.

DR. TERRY, of St. Louis, suggested in reference to the fact that in some brains, as Dr. Wilder pointed out, there was a multiplicity of fissures, while in others the pattern was more simple; whether a comparison had been made of the brains of giants and dwarfs. For it had been shown that the larger mammals have the most richly convoluted brains, while those of the smaller are smoother.

OSTEOLOGY OF THE ANSERES.

[Abstract.]

BY R. W. SHUFELDT, ASST. SURGEON U. S. ARMY
(RETIRED).

This extensive memoir upon which the present abstract is based, takes into consideration the entire group of North American anserine fowl composing the Family *Anatidæ*, which I make to include the subfamilies *Merginæ*, *Anatinæ*, *Anserinæ* and *Cygninæ*, or the Mergansers, the Ducks, the Geese and the Swans. Eventually this contribution will be included in my general work upon the osteology of the entire Class Aves, while in its production I have had before me in the way of material, skeletons representing nearly every species of the *Anatidæ* in the United States, the majority of which were especially collected for me for this purpose, and have since been donated to the Osteological Department of the U. S. National Museum. In other places I have described a number of North American fossil *Anseres*, and the information thus derived has likewise been used in the work. The memoir is fully illustrated by photographs, sketches and drawings of the skulls and other parts of the skeleton of various Swans, Geese, Ducks and Mergansers, and the entire subject has been worked up in a comparative way, taking into consideration all of the literature, and the various schemes of avian classification which have been published by other authors. It also compares the osteology of the *Anseres* with that of every group of birds having any natural relation to

them, such for example as the *Palamedeidae* and the *Phenicoptoridae* and others. The shading of the skeletal characters of one subfamily of the *Anatidae* into those of another is so gradual that the minor divisions of the group are characterized with difficulty by a consideration of their osteology alone. Still it has been accomplished here and the suborder *Anseres* defined, and likewise its several subdivisions to include the subfamilies herein named.

THE ANATOMY OF THE RENAL VESSELS IN RELATION TO DIGITAL EXPLORATION OF THE PELVIS OF THE KIDNEY.

[Abstract.]

BY DR. WM. KEILLER, GALVESTON, TEXAS.

In view of the fact that the kidney may be split up the dorsum almost from end to end with very slight hemorrhage, the author investigated the anatomy of the vessels within the kidney substance with a view to ascertaining the anatomical arrangement which makes this possible. The vessels were injected with a gelatin mass, hardened in formalin, and the kidney substance picked away from the vessels and pelvis. The specimens so dissected demonstrated that the vessels were arranged on each side of the pelvis and infundibula so that a kidney may be opened out into as it were three leaves joined at the hilum; the middle leaf formed by the pelvis and infundibula and a leaf on either side of this middle one formed of branching arteries and veins; and no arterial anastomosis takes place between the two vascular leaves across the pelvis and infundibula. No arteries therefore of any consequence are injured if the kidney be torn by the finger along its convex border from end to end. The pelvis of a normal kidney will not thus be opened by the finger which only enters the connective tissue plane between the vessels and pelvis; but the pelvis can be palpated and a dilated pelvis will be readily entered and explored.

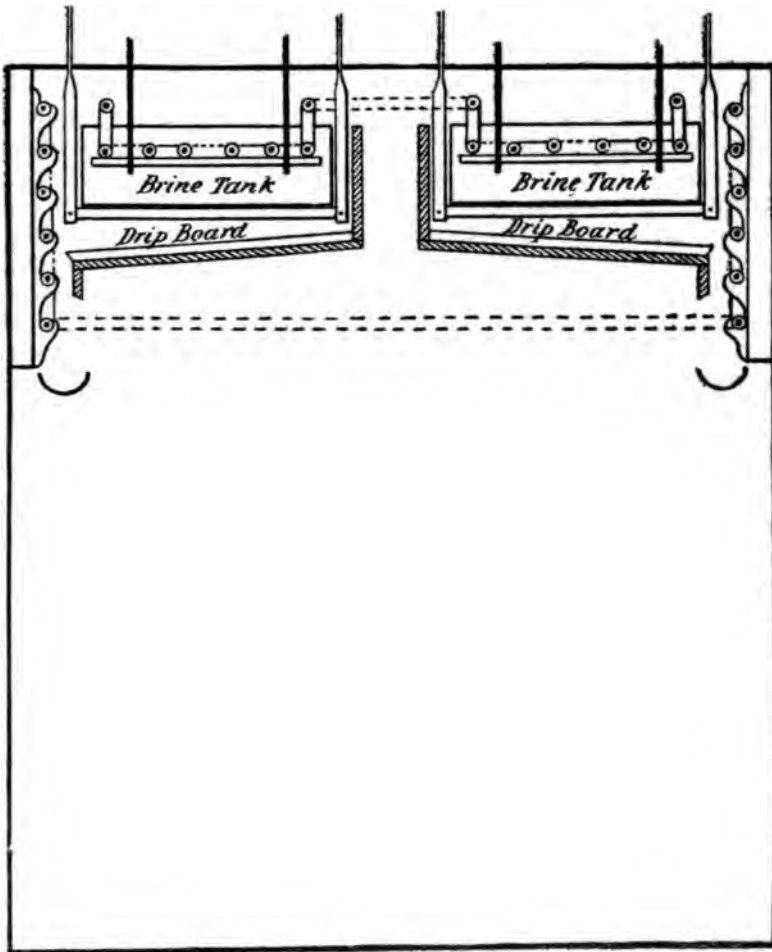
PRESERVATION OF ANATOMICAL MATERIAL AT THE UNIVERSITY OF BUFFALO.

BY DR. A. T. KERR, OF BUFFALO.

Some time since, I sent a circular letter to the various medical schools which I knew to have refrigerating plants.

From them I have received most courteous replies, and hope at some future time, with their permission, to publish the good points of their plants. While talking over the above replies, recently, with Dr. Mall, he suggested that I describe the University of Buffalo plant before this Association.

Subjects were formerly kept by immersion in brine; later a large ice box was constructed. In this it was possible to keep subjects from the latter part of July or August till needed in October or November. Ice alone was used, not ice



and salt, and most of the subjects kept fairly well, though occasionally one spoiled. With the growth of the medical school more subjects were required, and it became necessary to have more perfect means of preservation, so that they might be collected during the whole year. For that purpose a refrigerating plant was installed.

A machine of three tons refrigerating capacity, equivalent to $1\frac{1}{2}$ tons ice-making capacity, per twenty-four hour day was procured. The pipes were so arranged that the ammonia was expanded directly within the vault, and the indirect method of cooling the vault by pumping brine which had first been cooled by the ammonia was not employed. To hold the cold for a number of hours two brine tanks were placed in the top of the vault, as shown in the diagram. They were 15 inches deep by 2 feet 10 inches wide and 12 feet long. These were filled with calcium chlorid brine in which certain of the ammonia pipes were immersed.

The present vault is quite small, 9 feet wide, 13 feet long and $10\frac{1}{2}$ feet high. This will hold 50 or perhaps 75 bodies. At present, as the number is only 30, they are shelved, but as the number increases they will be piled. Moreover, if still greater capacity is required, the old ice box can be fitted with ammonia pipes.

Experience with the old ice box taught that insulation was of the greatest importance. The vault is built in a room with stone and brick walls, roofed and floored with concrete; within this an insulation of wood and paper, four layers of each, and two air spaces, besides which a large space between the wooden insulation and the masonry and concrete is filled with sawdust. Consequently it has been necessary to run the machine but four hours a day, winter or summer making little difference.

The machine was installed by the Case Refrigerating Machine Co. of Buffalo, at a cost of less than two thousand dollars, and is run by a gas engine of 20 horsepower (included in the above cost).

A 10-horsepower engine would be ample for running the machine, but our engine is also used to run a dynamo. It is difficult, therefore, to estimate exactly the yearly running expenses. I should say they did not exceed two hundred dollars, which is not much more than the cost of ice. The cost per subject per year for refrigeration decreases as the number of

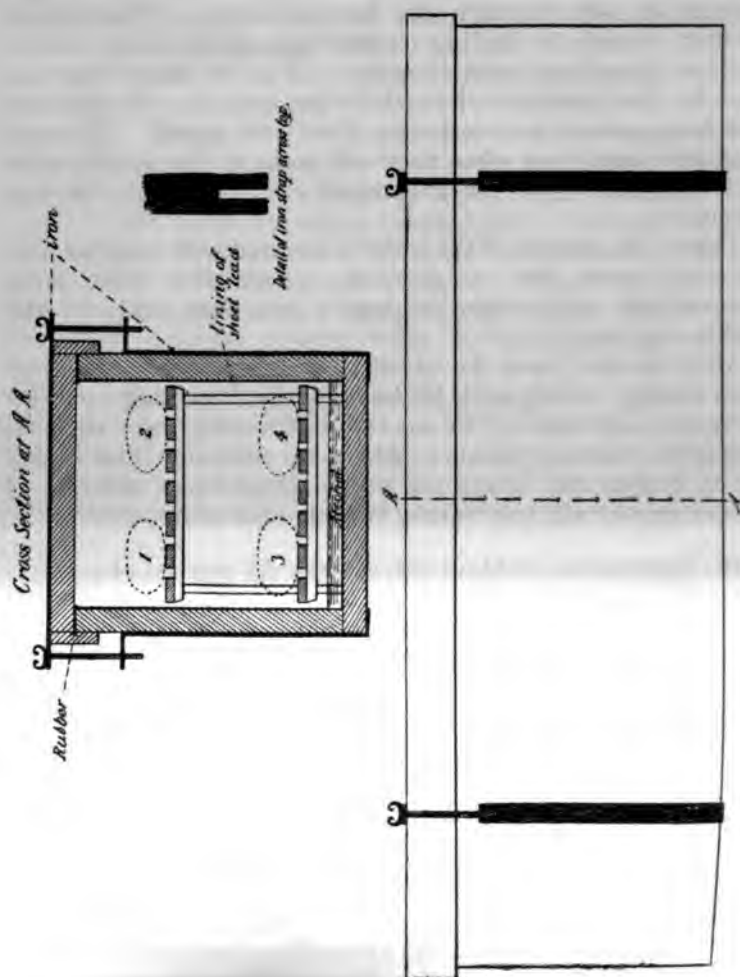
subjects increases. For the past year it cost us between three and four dollars.

Our material is generally received in good condition, from two to ten days after death. On receipt it is embalmed with arsenite of soda through the femoral artery. The arsenic solution is made by boiling together one pound white arsenic and two pounds of soda in water. Two to three liters are used for the injection, after which the body lays for twenty-four hours, when the arteries are filled with starch. If a body is in poor condition when received, some of the arsenic solution is injected into the abdominal cavity through the umbilicus.

The whole surface of the body is smeared with vaseline, and the head, hands, feet and genitals covered with toilet paper and wrapped with cotton bandage. It is then ready for the cold-storage vault.

After removal from the vault, if kept well wrapped to prevent drying, a body may be kept in the dissecting room for six months or more. The cost of embalming, injecting and wrapping is from 75 cents to \$1.00 per subject. The injecting at Buffalo has been done with a large brass syringe. I believe much better work may be done with compressed air.

DR. SHEPHERD, of Montreal, described a method of preserving subjects which had proved most satisfactory at McGill University, where they are obtained in summer for winter dissection. The subject is first injected with a fluid containing $1\frac{1}{2}$ pints by measure of solid carbolic acid, $1\frac{1}{2}$ pints of alcohol and 6 pints of glycerine. This is allowed to soak in for from 24 to 48 hours. The method of injection is similar to that of using a fountain syringe, except that a metal pot with spout and rubber tube is used. Then the paint is injected—red lead, 1 part; starch, 6 parts; alcohol, 2 parts, and water sufficient to make a thin paste. The subject is then placed in an air-tight box lined with sheet lead, having at the bottom a few inches of 95 per cent. alcohol. These boxes are made to hold three or four subjects, one above the other, or two, side by side, as in the sketch. Each subject is placed on a tray made of wooden slats. The lid and top of the box are covered with rubber and screwed down with 6 to 8 screws. The boxes are bound with iron bands into which the screws are placed.



CONSTITUTION.

SECTION 1. The name of the Society shall be the "ASSOCIATION OF AMERICAN ANATOMISTS."

SEC. 2. The Association shall have for its object the advancement of the anatomical sciences.

SEC. 3. The officers of the Association shall consist of a President, two Vice-Presidents, and a Secretary, who shall also act as Treasurer.

SEC. 4. The officers shall be elected by ballot every two years.

SEC. 5. The management of the affairs of the Association shall be delegated to an Executive Committee, consisting of its President, Secretary and three other members.

SEC. 6. One member of the Executive Committee shall be elected annually.

SEC. 7. The Association shall meet annually, the time and place to be determined by the Executive Committee.

SEC. 8. Candidates for membership must be persons engaged in teaching or in investigation in the anatomical sciences, and shall be proposed in writing to the Executive Committee by two members. Each proposal shall be made at or before the first session of any regular meeting of the Association. The proposal shall state the official position or occupation of the candidate and the character of his investigations. The election shall take place by ballot in open meeting, a two-thirds vote being necessary. Honorary members may be elected from those, not Americans, who have distinguished themselves in anatomical research.

SEC. 9. The annual dues shall be five dollars. A member in arrears for dues for two years shall be dropped by the Secretary at the next succeeding meeting of the Association, but

may be restored on payment of arrears, at the discretion of the Executive Committee.

SEC. 10. The rulings of the Chairman shall be in accordance with "Robert's Rules of Order."

SEC. 11. Five members shall constitute a quorum for the transaction of business.

OFFICERS FOR THE YEAR 1899-1900.

DR. GEO. S. HUNTINGTON, of New York City, - - - President.
 DR. F. H. GERRISH, of Portland, Me., - - First Vice-President.
 DR. G. C. HUBER, of Ann Arbor, Mich., - Second Vice-President.
 DR. D. S. LAMB, of Washington, D. C., - - Secretary and Treasurer.

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ALTERNATE.

DR. R. W. SHUFELDT, of Washington, D. C.

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Professor of Anatomy and Clinical Surgery, Cornell University Medical College, New York City.

GEOGRAPHICAL DISTRIBUTION OF MEMBERS.

New York,	35	Michigan,	2
District of Columbia,	12	Wisconsin,	2
Massachusetts,	10	U. S. Army,	2
Pennsylvania,	9	New Hampshire,	1
Maine,	6	Georgia,	1
Canada,	6	Minnesota,	1
Virginia,	5	Colorado,	1
Ohio,	5	California,	1
Connecticut,	4		
Illinois,	4	Germany,	3
Maryland,	4	England,	2
Missouri,	3	France,	2
Texas,	2	Scotland,	2
Louisiana,	2	Ireland,	1

Total, 128—118 active, 10 honorary.

PROCEEDINGS
OF THE
FOURTEENTH ANNUAL SESSION

OF THE
Association
of
American Anatomists,

HELD AT
ANATOMICAL LABORATORY OF
JOHNS HOPKINS UNIVERSITY, BALTIMORE, MD.,

DECEMBER 27 AND 28, 1900.



WASHINGTON, D. C.,
BERESFORD, PRINTER, 618 F STREET.
1901

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PROCEEDINGS OF THE FOURTEENTH SESSION.

The fourteenth session of the Association of American Anatomists, meeting with the American Society of Naturalists and affiliated Societies in Baltimore, Md., was held in the Anatomical Laboratory of the Johns Hopkins University, Thursday and Friday, December 27 and 28, 1900.

The meeting was called to order, December 27 at 10.20 A. M., by President George S. Huntington.

The Executive Committee reported and recommended the names of the following candidates for membership: Armour, Bardeen, Campbell, Flint, Knower, Kyes, Paton, J. H. Smith, E. A. Spitzka, Sudler and Warren. [See list of members.] Also a recommendation that, at the discretion of the secretary, the first five "Proceedings," now out of print, should be reprinted. Also a recommendation that the Association endorse the proposition for the establishment of a psycho-physical laboratory in the Bureau of Education, Washington, D. C.

By unanimous consent the Secretary cast the ballot for the nominees for membership. The Association also authorized the Secretary to reprint the "Proceedings" as recommended. The recommendation to endorse the psycho-physical laboratory was not agreed to, and was referred to a committee to be appointed by the president to report at a future meeting. It was discussed unfavorably by Drs. Holmes and Hrdlicka.

The Secretary and Treasurer made the following report, for the year 1899-1900:

WASHINGTON, D. C., *December 22, 1900.*

TO THE MEMBERS OF THE

ASSOCIATION OF AMERICAN ANATOMISTS:

Your Secretary and Treasurer herewith submits his report for the year 1899-1900. A provisional report was made at the May meeting in this city.

The Proceedings of the twelfth and thirteenth sessions, held, respectively, in New Haven and Washington, were duly printed, bound together under one cover, as authorized at the May meeting, and have been distributed, leaving, however, a number of copies on hand which are available to members, and would be especially useful for presentation to libraries. The Secretary has also copies of the Proceedings from the sixth to eleventh, inclusive, which are similarly available.

The Secretary has had many requests, especially from libraries, for copies of the Proceedings from the first to fifth, inclusive, which are out of print. Two hundred copies of these, bound under one cover, can be printed for \$80.

In addition to the list of members there are thirty-three libraries and journals on the regular mailing list.

The financial exhibit is as follows: December 22, 1899, the Association was indebted to the Treasurer \$86.36 for monies advanced to pay certain expenses; during the year there has been paid for dues, \$465.75, and subscriptions to the *Journal of Anatomy and Physiology*, \$26.50; total receipts, \$492.25. The expenditures were: for postage, \$25.67; printing, \$144.92; stationery, \$1.25; items of express, telegram, copying, type-writing and drawing, \$14.43; due the Treasurer, \$86.36; subscriptions to *Journal of Anatomy and Physiology*, \$25.96; the Secretary's expenses at the New Haven meeting, \$14.19; the assessment of the Association for the same meeting, as its share of the entire expense of the affiliated societies, \$2.00; total expenditures, \$314.78. Leaving a balance in hand December 22, 1900, \$177.47.

The Treasurer would make the following remarks on this exhibit: It will be noticed how small an assessment is imposed on the Association for the expenses of the meetings with the affiliated societies and Naturalists—only \$2.00. The bill for the share of this Association in the expenses of the triennial Congress has not yet been rendered, but will probably be as much as in previous years, namely, nearly one hundred dollars. In addition to this, each member attending

the Congress is assessed five dollars, which he has to pay as an individual. The Secretary would ask the Association to consider the question whether it would not be more satisfactory to have an intercalary meeting with the Association for the Advancement of Science than triennially with the Congress. This would give us two meetings a year, like the Anthropological Section of that Association, which is now also to meet with the Naturalists and affiliated societies.

The members will observe that the difference between the subscriptions received for the *Journal of Anatomy and Physiology* and the expense of ordering the same is this year a balance of fifty-four cents in favor of the Association, a part of which must be debited to postage, showing that the cost to the subscriber and to the Association are nearly evenly balanced. The Secretary would therefore suggest that the arrangement continue by which subscribers may order through the Secretary's office.

At the close of the May meeting there were on the rolls 118 active, and 10 honorary members; total, 128. Since then we have lost Prof. Wm. Anderson, F. R. C. S., Eng., &c., Lecturer on Anatomy, St. Thomas' Hospital, London, an honorary member. Dr. Woods Hutchinson, late Professor of Comparative Pathology, &c., at University of Buffalo, has been dropped because the Secretary has been unable to establish any communication with him, and he is also in arrears for dues. Dr. A. L. T. Schäper has removed to Breslau, Germany, where he has been appointed a Professor in the University of that city. The membership is now, therefore, 116 active, 9 honorary members; total, 125. I may note in passing that 18 members are also members of the Society of Naturalists.

Seven members of this Association are in arrears for two years and five for three years; total arrearages \$225.00.

Respectfully submitted,

D. S. LAMB,
Secretary and Treasurer.

No reports were received from the Delegate to the Executive Committee of the triennial Congress of American Physicians and Surgeons, nor from the Committee on Anatomical

Peculiarities of the Negro, nor from the Committee on Table at Naples. Dr. Wilder, from the Committee on Anatomical Nomenclature, reported progress.

The President appointed a committee, consisting of Drs. Huber, Carmalt and Barker, to report nominations for Delegates to the Executive Committee of the Congress and a new member of the Executive Committee of this Association. Also a committee, consisting of Drs. Mall and Holmes, to audit the accounts of the Treasurer.

Dr. Huntington then read the Presidential address, subject: "The Morphological Museum, as an educational factor in the University system."

The following papers were also read:

Dr. Holmes, Philadelphia; "The use of wet specimens."

Dr. Chas. R. Bardeen, Baltimore: "Advantages and limits of the method of reconstruction with wax plates in anatomical and embryological investigations." Illustrated by specimens &c. Discussed by Drs. Huber, Minot, Barker, W. S. Miller and Huntington.

Dr. Bardeen: "Demonstration of a new freezing microtome."

Dr. Carmalt, New York City: "Specimen of cyclopia," with cast and photographs. Discussed by Dr. Minot.

Invitations were received from the Johns Hopkins, the University and Arundel Clubs, to the members of the Association, to avail themselves of the hospitalities of the club rooms.

The Association then took a recess for a luncheon, given by the Johns Hopkins University, in the Hospital building.

Reassembled at 2.20 P. M.

The following papers were then read.

Dr. Harrison, Baltimore: "A caudal appendage in a human infant." Illustrated by specimen and photographs. Discussed by Dr. Hrdlicka.

Dr. Hrdlicka, New York City: "Typical forms of shaft of

long bones other than the tibia." Illustrated by specimens and diagrams. Discussed by Drs. Huber and Huntington.

Dr. Hrdlicka: "Notes on the first and second ribs, and a demonstration of bicipital, bicaudal, notched and perforated ribs in man; also notes on articulation of ribs with each other." Illustrated by specimens. Discussed by Dr. Huntington.

Dr. Corson, of Savannah, Ga., not being able to be present, his paper, "The value of the X-ray in the study of normal anatomy," was read by Dr. Kerr, of Cornell University. Illustrated by photographs of the human membral epiphyses at the thirteenth year.

Dr. Huntington: "On the arrangement of the pectoral group and allied muscles in the Cynomorpha, with special reference to the human myological variations of this region." Illustrated by photographs.

Dr. Holmes: "The levator ani muscle." Discussed by Dr. Huntington.

Dr. Mall, Baltimore: "Development of human diaphragm." Illustrated by diagrams and specimens.

Dr. Stroud, of Cornell University, was unable to be present. A photograph sent by him showing "Apparatus for demonstrating the circulation of the blood," was passed around among the members.

Dr. Huntington: "Variations of the inferior cava." Illustrated by photographs.

Dr. Mall: "The origin of the lymphatics of the liver." Illustrated by models. Discussed by Dr. Huber.

The Association then adjourned.

At 8 P. M., President Gilman, of Johns Hopkins University, made an address of welcome at McCoy Hall, followed by a lecture by Prof. Frank Russell, on "The Indians of the Southwest." Illustrated by lantern slides. And then a reception in the same hall to the visiting societies, by the University.

FRIDAY, DECEMBER 28TH.

The Association reassembled at 9.40 A. M. The Executive Committee reported favorably on the applications for membership of Drs. Pohlman and Hundee, of Cornell University, and the Secretary was directed to cast the ballot for them, and they were declared elected. [See list of members.]

The following papers were then read :

Dr. W. S. Miller, Madison, Wis.: "The lobule of the lung." Illustrated by models, diagrams and lantern slides. Discussed by Drs. Huntington and Huber.

Dr. Primrose, Toronto: "Frozen sections." Illustrated by lantern slides.

Dr. Miller: "Epithelium of pleural cavities." Illustrated by lantern slides.

E. A. Spitzka, New York City: "Preliminary report with projection drawings illustrating the topography of the paracæles in their relation to the surface of the cerebrum and cranium." Abstract. Illustrated by photographs and diagrams.

Mr. Spitzka: "Contribution to the question of fissural integrality of the paroccipital; observations on one hundred brains." Illustrated by drawings.

Mr. Spitzka: "The mesial relations of the inflected fissure; observations on one hundred brains." Illustrated by photographs and diagrams.

Mr. Spitzka: "The brains of two distinguished physicians, father and son; a comparative study of their fissures and gyres." Illustrated by drawings and photographs. Discussed by Drs. Lamb and Huntington.

Dr. Mellus, Baltimore: "Bilateral relations of the cerebral cortex." Illustrated by diagrams. Discussed by Dr. Barker.

Dr. Bardeen: "Methods of statistical study in the dissecting room with special reference to the peripheral nervous system." Illustrated by charts. Discussed by Dr. Huntington.

Dr. Harrison: "Wandering of the skin during development,

in relation to the distribution of cutaneous nerves." Illustrated by diagrams.

Mr. Max Brödel, Baltimore: "Intrinsic bloodvessels of the kidney and their significance in nephrotomy." Illustrated by specimens and diagrams. Discussed by Dr. Holmes.

Dr. T. S. Cullen, Baltimore: "Histology of the endometrium." Illustrated by specimens and drawings.

Dr. M. T. Sudler, Baltimore: "The architecture of the gall-bladder." Read by title.

Dr. Minot, Boston: "The classification of glands." Read by title.

Dr. Barker, Chicago: "Method of teaching the anatomy of the central nervous system to large classes of students." Read by title.

Dr. Huber, from the Nominating Committee, reported the following names: For the Executive Committee of the Association, Dr. Mall; for Delegate and Alternate to Executive Committee of the triennial Congress, Drs. Blake and Baker. On motion, the Secretary was directed to cast the ballot for these gentlemen, and they were elected.

Dr. Mall, of the Auditing Committee, reported the Treasurer's accounts correct. Report accepted.

On motion, the thanks of the Association were tendered to the University authorities, and especially the Medical School, for courtesies received.

The Association adjourned *sine die* at 1.40 P. M.

The following members were present at sometime during the meeting: Bardeen, Barker, Browning, Carmalt, Harrison, Holmes, Huber, Huntington, Hrdlicka, Kemp, Kerr, Knower, Lamb, Mall, Mellus, W. S. Miller, Minot, Paton, Piersol, Primrose, Holmes Smith, E. A. Spitzka, Sudler—total 23; besides Mr. Brödel and Dr. Cullen, of Johns Hopkins Medical School, who contributed papers, and also many visitors.

At 3 P. M., in McCoy Hall, the subject of "The attitude of the State toward scientific investigation" was discussed by the

following gentlemen : Prof. H. F. Osborn, Columbia University, New York City ; Prof. W. B. Clark, Johns Hopkins University ; L. O. Howard, Chief of Division of Entomology, and B. T. Galloway, Director of Plant Industry, both of the Agricultural Department, Washington, D. C., and W. T. Sedgwick, Massachusetts Institute of Technology.

At 7 P. M. a subscription dinner was given at "Hotel Rennert," followed by the annual address of the President of the American Society of Naturalists, Prof. E. B. Wilson.

CONSTITUTION.

SECTION 1. The name of the Society shall be the "ASSOCIATION OF AMERICAN ANATOMISTS."

SEC. 2. The Association shall have for its object the advancement of the anatomical sciences.

SEC. 3. The officers of the Association shall consist of a President, two Vice-Presidents, and a Secretary who shall also act as Treasurer.

SEC. 4. The officers shall be elected by ballot every two years.

SEC. 5. The management of the affairs of the Association shall be delegated to an Executive Committee, consisting of its President, Secretary and three other members.

SEC. 6. One member of the Executive Committee shall be elected annually.

SEC. 7. The Association shall meet annually, the time and place to be determined by the Executive Committee.

SEC. 8. Candidates for membership must be persons engaged in teaching or in investigation in the anatomical sciences, and shall be proposed in writing to the Executive Committee by two members. Each proposal shall be made at or before the first session of any regular meeting of the Association. The proposal shall state the official position or occupation of the candidate and the character of his investigations. The election shall take place by ballot in open meeting, a two-thirds vote being necessary. Honorary members may be elected from those, not Americans, who have distinguished themselves in anatomical research.

SEC. 9. The annual dues shall be five dollars. A member in arrears for dues for two years shall be dropped by the Secretary at the next succeeding meeting of the Association, but

may be restored on payment of arrears, at the discretion of the Executive Committee.

SEC. 10. The rulings of the Chairman shall be in accordance with "Robert's Rules of Order."

SEC. 11. Five members shall constitute a quorum for the transaction of business.

OFFICERS FOR THE YEAR 1900-1.

DR. GEO. S. HUNTINGTON, of New York City, - - - President.
 DR. F. H. GERRISH, of Portland, Me., - - First Vice-President.
 DR. G. C. HUBER, of Ann Arbor, Mich., - Second Vice-President.
 DR. D. S. LAMB, of Washington, D. C., - Secretary and Treasurer.

**DELEGATE TO EXECUTIVE COMMITTEE OF CONGRESS OF AMERICAN
 PHYSICIANS AND SURGEONS 1900-3.**

DR. J. A. BLAKE, of New York City.

ALTERNATE.

DR. FRANK BAKER, of Washington, D. C.

EXECUTIVE COMMITTEE.

DR. E. W. HOLMES, of Philadelphia, Pa.
 DR. C. S. MINOT, of Boston, Mass.
 DR. F. P. MALL, of Baltimore, Md.
and the
 PRESIDENT and SECRETARY, *ex officio*.

COMMITTEE ON ANATOMICAL NOMENCLATURE.

DR. H. B. FERRIS, of New Haven, Conn.
 DR. F. H. GERRISH, of Portland, Me.
 DR. GEO. S. HUNTINGTON, of New York City.
 DR. E. C. SPITZKA, of New York City.
 DR. BURT G. WILDER, of Ithaca, N. Y., *Secretary*.

**COMMITTEE ON CIRCULAR IN REGARD TO ANATOMICAL PECULIARITIES
 OF THE NEGRO.**

DR. D. S. LAMB, of Washington, D. C.
 DR. FRANK BAKER, of Washington, D. C.
 DR. D. K. SHUTE, of Washington, D. C.

MEMBER OF SMITHSONIAN COMMITTEE ON THE TABLE AT NAPLES.

DR. GEO. S. HUNTINGTON, of New York City.

1. The first step is to identify the problem or question that needs to be answered. This involves understanding the context and the specific requirements of the task.

LIST OF MEMBERS.

HONORARY MEMBERS.

Cleland, John, M. D., LL.D., D. Sc., F. R. S. The University,
Glasgow, Scotland.

Regius Professor of Anatomy, University of Glasgow.

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Professor of Anatomy, University of Heidelberg.

His, Wilhelm, M. D. Königstrasse 22, Leipzig, Germany.

Professor of Anatomy, University of Leipzig.

Koelliker, A. von. Würzburg, Germany.

Professor of Anatomy, University of Würzburg.

Macalister, Alexander, LL. D. (McGill University). Cambridge,
Eng.

Professor of Anatomy, University of Cambridge.

Ranvier, L. Paris, France.

Professor of General Anatomy, *Collège de France*; Member of the *Institute*
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Turner, Wm., M. B., F. R. C. S. Ed., M. R. C. S. Eng., D. Sc., LL. D.,
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THE MORPHOLOGICAL MUSEUM AS AN EDUCATIONAL FACTOR IN THE UNIVERSITY SYSTEM.

BY DR. GEO. S. HUNTINGTON, NEW YORK CITY.

The educational value of the modern morphological museum has of late years received such general recognition that we may well regard its position as established in the university system. Not only do the departments of undergraduate instruction draw more and more extensively upon this portion of the university equipment for the illustration of courses and demonstrations, but the museum itself has assumed its proper relation to independent scientific research and to the investigation of biological problems. It has seemed to me desirable to present to this association—whose members are so largely both teachers of anatomy and investigators of the science—some account of the progress made during the last decade in museum work in the department of vertebrate morphology. More especially does it appear proper at this time to note the present stage of development of the modern anatomical museum, because we have, I think, reached a period at which we can look back over a series of busy years and gauge correctly the value of the results obtained, as well as forecast the probable future development of this work. Ten or fifteen years ago the morphological museum—established on lines of modern thought and research—existed in an embryonic form in only a few of our institutions of learning. From this period date a number of excellent monographs—in which the authors outline the plans of a proposed anatomical museum designed to meet the requirements demanded by the advance of the biological sciences—from the standpoint both of the teacher and the investigator. Prominent among these interesting publications are the following:

"Outlines for a Museum of Anatomy. Prepared for the Bureau of Education," by R. W. Shufeldt. 1885.

"Die Aufgaben der anatomischen Institute," by Professor A. Koelliker, 1884. An address delivered at the opening of the new anatomical institute in Würzburg on November 3, 1883.

"The Educational Museums of Vertebrates," an address before the Section of Biology of the American Association for the Advancement of Science, at Ann Arbor, August, 1885, by Professor B. G. Wilder.

"The Synthetic Museum of Comparative Anatomy as the Basis for a Comprehensive System of Research," by John A. Ryder, Professor of Comparative Embryology at the University of Pennsylvania, Philadelphia. 1893.

As I look over the list of these and other contributions to the literature of the anatomical museum I am tempted to characterize the period between 1885 and 1895 as the prophetic era, foreshadowing the establishment and recognition of the most essential and valuable aid to scientific anatomical instruction and research which our universities to-day possess. When we analyze the great and radical changes which our methods of morphological teaching have experienced since that time, we shall, I believe, agree that the demonstrative and objective instruction which has replaced so largely the old didactic lecture is intimately and organically connected with the evolution of the modern anatomical museum. It will perhaps best serve the purpose of my communication if in the following I confine myself to the facts as they are most familiar to me in the case of my own university, which, I believe, may fairly be taken as a concrete example of the general progress which has marked the period in question in the scientific institutes throughout our country.

The establishment of a museum of vertebrate comparative anatomy, on lines designed to illustrate and demonstrate to the fullest extent possible the morphological truths embodied in the doctrines of evolution, heredity and descent is an undertaking requiring years of careful and successful work before even a satisfactory beginning is made. The foundation of the museum at Columbia University was laid in 1889, and, while in many directions our progress has been rapid and the results gratifying, yet we feel that to-day but the outlines exist along which future growth is to take place.

I. PLAN AND SCOPE OF THE MUSEUM AND ITS RELATION TO ANATOMICAL INSTRUCTION.

I may in the first place call your attention to the general plan and purpose of the museum, in accordance with which the objects have been collected and prepared, and to the re-

lation existing between the museum and the undergraduate instruction in anatomy.

The following considerations present themselves :

1. The fundamental plan of the museum includes in the first place a general exposition of the vertebrate classes, whose purpose is to present the cardinal points in the anatomical structure of the great vertebrate classes and subclasses.

Each vertebrate class, subclass and order is represented by one or more typical forms in preparations illustrating as fully as possible the skeletal and locomotory apparatus, the circulatory and nervous systems, and the alimentary, respiratory and uro-genital tracts.

This display forms the guiding thread to the study of the individual forms—in respect to typical structures, *i. e.*, the fundamental anatomical characters of the mammal, bird, reptile, amphibian and fish are grouped together to afford a comprehensive view of the entire organism, from which starting point the detailed investigation of characteristic structures in their various modifications is to be followed through the series of species belonging to the *same class*.

To illustrate : the typical structure of the avian pectoral girdle is represented in the collection by the girdle of *Palamedea cornuta*, the horned screamer. It is here shown to contain three elements—the scapula, coracoid and furcula.

Turning to the corresponding series demonstrating the successive modifications of this structure, we find it as a link in the group devoted to the development of the vertebrate shoulder girdle. The various modifications in shape, extent and sternal attachment of the complete furcula are first illustrated, together with preparations of the membranous and ligamentous structures, which have a bearing on the general morphology of the episternal apparatus.

In the next place the avian girdle is found to pass from the type represented by *Palamedea*, in which all three skeletal elements are fully developed, to the intermediate condition seen in the toucan, where the furcula is developed as a bilateral structure, the two segments not fusing over the sternum, until we come to the brevipennate group of birds, of which *Dromæus* still has rudimentary anterior collar bones, whereas in *Struthio*, *Rhea* and *Casuarius* these have lost their identity by becoming fused with the scapula.

In the second place this division of the museum affords the

basis for broad comparison between the organizations of the different vertebrate classes. For example, the comparison of the entire anatomical system of a typical reptile, bird and mammal will show why reptiles and birds, although differing widely in structural detail, yet have sufficient general morphological characters in common, as against the mammal, to entitle them to be grouped under the single broad head of the Sauropsida.

Then, again, this portion of the museum is designed to elucidate the important problems of derivation of vertebrate sub-classes.

2. The second main division of the museum deals with the development, evolution and comparative structure of single organs and systems. The homologies in the different classes, and the modifications of the typical structures in each class, are here demonstrated as completely as possible. In many respects this portion of the work is educationally the most important. We draw most extensively upon it for our anatomical undergraduate instruction in the elucidation of problems in human morphology. I cannot take time in even superficially outlining the detailed development of this division of the anatomical museum. The enumeration of a few of the principal series must suffice.

I may instance the series dealing with the morphology of the alimentary tract, and especially the group devoted to the structure of the ileo-colic junction, cæcum, vermiform appendix and the allied segments of the large intestine. This series, including at present over 600 preparations, and beginning with type forms illustrating this portion of the alimentary canal in fishes, amphibia, reptiles and birds, passes to a complete demonstration of the structures in mammals, terminating with several specimens of the four anthropoid apes and leading up to the detailed study of the human cæcum and appendix, the numerous variations of which are all represented by one or more type specimens. In the same way the various forms of the stomach and the modifications of small and large intestine constitute a series of great morphological interest.

Other series deal with the vertebrate respiratory apparatus, especial stress being laid on the clear demonstration of the development, evolution and structure of the mammalian lung. Closely connected with this group is the serial exhibit dealing with the heart and circulatory system. Other series include

the nervous system, the genito-urinary tract, the pelvic and pectoral girdles, the mammalian temporal, periotic and tympanic bone, etc.

Special attention is given in this department of the museum to the demonstration of human anatomy. Eventually it is hoped that every portion of man's structure will be fully and exhaustively illustrated by perfect preparations. The museum should afford the medical student the opportunity of directly verifying his text-book information and should be a most valuable guide and aid to the practical anatomical study of the individual in the dissecting room. Moreover, many structures, as we all realize, are never fully examined or completely demonstrable to the student in the dissecting room. Aside from the individual differences in the cadaver in respect to development and state of preservation, and in the element of alteration of structure by diseased conditions, certain parts require special methods of preparation, such as the auditory apparatus; others necessitate for their exposition the sacrifice of surrounding structures to a degree not warranted by the practical requirement of getting the greatest amount of detail from the dissection of a single cadaver. Moreover, even the structures which are ordinarily fully examined and demonstrated in the dissecting room on the fresh subject, can be shown with great profit in the museum in various preparations by different methods. For example, the museum contains hardened situs preparations, organs hardened, distended and fenestrated, injection and corrosion preparations, etc., to illustrate fully the anatomical structure of each part and to enable the student to extend and amplify his observations on the cadaver.

Again, in connection with this department of the museum, I find it of distinct advantage to establish small comparative series designed to illustrate the development and normal anatomy, as well as the more important variations, of certain adult human conditions. These groups are accompanied by tablets, describing as fully as necessary the purpose of the exhibit, and drawings which emphasize the points at issue.

Thus, for example, under the heading of the cardinal sinus of the adult human heart—as part of the series exhibiting cardiac anatomy—the following group is placed with full explanatory text:

1. Heart and vascular system of *Raja ocellata*—various

preparations to show embryonic type of mammalian heart before septal division, ducts of Cuvier and symmetrical cardinal veins.

2. Heart of *Python molurus*—hardened and distended, with sections showing: (a) sinus venosus of right auricle; (b) valves of sinus venosus and their relation to the Eustachian and Thebesian valves of the mammalian heart; (c) pulmonary veins; (d) persistent left precava.

3. Heart of *Struthio africanus*—injected, showing persistent avian left precava—with its relations to pericardium and coronary vein.

4. Ruminant heart (*Antelope cervicapra*)—mammalian type of normal persistence of left precava.

5. Series of normal human hearts—showing, in various preparations, coronary sinus, Thebesian and Eustachian valves—both foetal and adult.

6. Series of well-developed folds of Marshall in foetal and adult hearts.

7. As soon as obtained, the final member of this group will be added as a preparation showing the normal persistence of the left precava in the adult human subject.

Instances in which a similar limited and selected group of preparations may be with advantage established for the elucidation of special details in human anatomy could be almost indefinitely multiplied.

I have noted at random :

1. Development of axis and atlas.
2. Ligaments and tendons of shoulder joint.
3. Greater and lesser sciatic ligaments and relation to hamstring muscles and coccygeus.
4. Postcava and variations.
5. Carpus and tarsus.
6. Sacrum and vertebral variations.
7. Aortic arch and variations of primary branches.
8. Various myological problems.
9. The peritoneum.

The question as to the practical application of this educational material to the requirements of undergraduate instruction in anatomy deserves careful consideration from several points of view :

1. Primarily the museum should afford a consecutive and critical serial exhibition, arranged and administered in such a

manner that for both undergraduates and advanced students the preparations should be readily accessible and capable of being examined with only such restrictions as the safety of the object demands. The museum should be the reference library of the student in the widest sense, where the undergraduate can review and extend his anatomical knowledge on the hand of the actual object of his study, and where the advanced worker will find the necessary material in directing and supplementing his research in any given problem under investigation.

2. In the demonstrative teaching of the anatomical course the material of the museum in our experience can best be utilized in two ways:

a. It is our custom, in approaching any one of the large subdivisions of the course—such as the respiratory and circulatory system, the alimentary canal or genito-urinary tract—to devote a portion of the available time to a preliminary general consideration of the development, peculiarities of morphological structure and the physiological significance of the parts involved. For this purpose a judicious selection of a limited number of the museum preparations is made, and the objects are arranged in the form of a series, each number of which distinctly and forcibly illustrates a developmental stage or a significant and important structure or functional fact. It is necessary to limit the preparations thus selected in number to avoid confusion and superfluous expenditure of time, but it is surprising how clearly and convincingly the main broad lines of vertebrate development and evolution and the relation between structure and function can be brought out in a comparatively short series of selected preparations. Every teacher knows and appreciates the difference in the quality of instruction and its results between a demonstration of models and drawings, schematic or otherwise, and one referring directly to the natural object. The most important function of the museum, as an integral part of the educational system of the university, is exerted in supplying the material necessary for this kind of demonstrative teaching. Practically I find in the schematic blackboard sketch or the more carefully prepared colored chart a most valuable adjunct. The drawing should, however, be made directly from the actual preparation demonstrated and the student should have the opportunity of directly comparing both. In this way salient

points can be accentuated and the attention properly and immediately directed to the important facts which the preparation is designed to illustrate.

b. In connection with the class-room demonstration it is at times desirable to deal with general problems of vertebrate morphology from the higher standpoint which, on the hand of a more extensive series, affords a wider view of the structures concerned. I find that this can best be accomplished by a photographic lantern slide demonstration, in which a very considerable number of forms can be exhibited to the class in a comparatively short time. It has been our practice to photograph the preparations when finished, but before they are permanently mounted or included in the museum series. As a practical matter the best results are obtained by vertical exposure, the object being placed in suitable trays and covered by clear fluid—water or alcohol. In this way the disadvantage, resulting from the distortion and reflection of the jar containing the specimen when finally mounted, is obviated.

The resulting photograph forms part of the museum record and is useful in many ways. Properly labeled, it forms an excellent guide to the study of the preparation, and it can be used directly for reproduction in publications, or be made the basis of the drawing. Finally, as the completion of the series warrants it, the negatives yield a set of lantern slides which can be used in the teaching of the department as well as in extending the use of the museum material in other institutions.

3. The special courses in comparative anatomy and embryology, which are offered as optionals, electives, or for the higher university degrees, make demands which the museum should meet as fully as possible. In the first place, I find that the forms which can readily be obtained in numbers, and supplied to the students for their actual personal use in the laboratory courses, require in many cases comparison with allied types which, by reason of their rarity and value, can only be represented in the permanent collection of the museum. The courses can thus be extended and made infinitely more valuable and instructive. Again, every practical laboratory teacher will know the value of placing before the student a carefully and clearly executed preparation and reviewing the structures which he is to expose and determine for himself by the dissection of the fresh material on hand. This use of the museum is entirely apart from the valuable

and instructive deductions which a series of significant variations of normal structures will enable the student to make.

Moreover, in many respects the museum fulfills one of its most important practical functions in enabling the teacher to direct the student's attention, at the proper points in any laboratory course, to the corresponding structures and their modifications in selected preparations ranging throughout the entire vertebrate series. The broad and general application of the knowledge gained by the detailed study of any individual form can only by these means be impressed on the student, and it is thus that the anatomical museum accomplishes one of the main purposes of morphological study.

II. RELATION OF THE MUSEUM TO ORIGINAL RESEARCH AND ADVANCED STUDY.

Of equal importance with the value of the museum for undergraduate instruction is its influence in promoting original investigation and advanced morphological study. Its very existence carries this with it. It constantly opens up, in creating the nucleus around which the institution is to grow, lines of investigation and research which ultimately return their products to the museum as permanent records of the work accomplished, and thus prove sources of continual and valuable additions.

The museum in itself forms the basis for a progressive extension of morphological investigation. It accomplishes this in several directions. In the first place, the generalization of the structures presented by different types, which marks the central purpose of the institution, forms a circle from whose circumference at any point the line of a new and more extended investigation can be drawn. In fact, if the museum is to grow and develop according to its original intent, it is requisite that such enlargement should take place.

As the museum grows the vital questions of derivation and ancestry of forms must be investigated on the hand of constantly increasing material, which will open up points of view heretofore unattained. With each new accession to any group the capacity of the museum for extension of original thought and investigation increases. Any research opens at some point in its course side lines which may be of the utmost value. It is here that the immediate possibility of serial comparisons on a large scale afforded by the museum becomes of the

greatest importance. The museum represents in its complete condition a morphological reference depository. It functions in connection with the morphological library, but it possesses the inestimable advantage of presenting the actual objects instead of plates and descriptions, often at variance with each other, incorrect and incomplete in detail and failing to elucidate just the question which it is desired to solve.

In this sense the museum fulfills its highest functions, stimulating and directly promoting investigation and rendering such investigation fruitful and effective by contributing the series necessary for comparison and reference.

It may hardly be necessary to touch on the effect of this work on those who are engaged in it. It attracts men whom the university is glad to number among its students and graduates, and who in other institutions—as teachers and investigators—will reflect credit on their training. If from among the growing numbers of our medical students even a few are made to develop into scientific workers, I should yet hold those few—in their prospective value to the university and to science—as balancing the long list of medical graduates whom we annually send out at our commencement.

III. RELATION OF THE MUSEUM TO OTHER DEPARTMENTS OF THE UNIVERSITY.

There is scarcely a department of biological or medical instruction and investigation which is not in intimate relation with some portion of morphology, and which will not benefit by a connection with the museum and by access to its collections.

In physiology, the science dealing with the function of the machine which itself is the object of the study in morphology, the connection is obvious. But the tremendous advantage which will accrue to each of these sciences by closer mutual association, through the link of the comparative anatomical museum, can scarcely be estimated. Morphology offers in the series of modifications which different forms present in their structure, a field of nearly unlimited choice for the interpretation of the physiologist. The physiological study of an organ in a certain form—as the dog—may lead the investigator to certain results which apply in the first plan to the species examined. If now the morphology of the organ is accessible to the physiological investigator not only in a complete series

of the dog's own order, the Carnivora, but through the entire mammalian class, and beyond this limit, so as to include the homologous structures, in other vertebrate classes, the result of the investigation becomes potentially amplified to a corresponding degree.

The investigator can not only reason from analogy as to the results of similar experiments extended as far as deemed advisable through the vertebrate classes and orders, but he can also, guided by the morphology of the structure under consideration, select types which, from their anatomical configuration, promise unequivocal confirmation and extension of the results yielded by the first experiment. How frequently the success of an investigation depends on details of anatomical structure every physiologist will attest. It is often the question of the length of an arterial vessel without branches, or the arrangement of a duct, or the combination of several peripheral nerves. The museum of comparative morphology converts a hap-hazard search for a suitable form into one which will select the most desirable type with certainty.

In turn the generalized view of organized structure obtained in the comprehensive system of the museum will afford to the morphologist the aid which is to be found in the broad physiological interpretation of the modifications exhibited. Thus these two fundamental departments will be brought into closer contact with each other, a contact which cannot fail to redound equally to the benefit of both. I believe that a closer association of anatomy and physiology, such as is afforded by the link of the museum, is of very distinct advantage in undergraduate instruction. The modern development of science inevitably leads to a high degree of specialization, which naturally becomes apparent in the teaching of any department. The general advantage of this is obvious, provided touch is not lost with cognate branches.

The morphological museum preserves this vital connection between anatomy and physiology more than any other single factor in the university equipment. Moreover, the museum has important relations to the practical departments of medical teaching and to pathology. Nearly all important advances, especially in departments such as diseases of the eye and ear, the diseases of women, surgery in general and in its specialized branches, depend primarily on some morphological

question for their inception, rendering this or that proposed operative interference proper and advantageous, or interdicting it.

A museum which offers to the medical specialist not only the normal and variant human structures which constitute his field of work, but which enables him at the same time to examine the homologous parts of other vertebrates for the purpose of gaining clearer insight into obscure morphological conditions and the origin of aberrant formations, will certainly be an aid to practical advance which can be obtained by no other means. It is needless to point out further connections of a similar character, or to more than touch upon the line along which pathology and embryology meet, a line which is sufficiently extensive, but obscure because the assistance which vertebrate embryology can afford to the pathologist is only rarely attainable in the form which the museum proposes to offer, viz: complete sets of serial preparations. As the museum develops it is proposed to take successively certain portions of the subject, such as eye, ear, larynx, brain, genito-urinary tract, etc., and to develop these as fully as possible, demonstrating the results in the form of an exhibition to a selected number of scientific men who are directly interested in the matter as expert specialists. The importance of this feature of the museum work will thus be brought more particularly to the attention of those best able to judge of its value and to profit by the same. I have no doubt that from this class of men valuable work in investigation will be secured.

IV. UTILIZATION FOR THE PURPOSES OF THE MUSEUM OF THE MATERIAL OBTAINED FROM THE DIS- SECTING ROOM, AND REFERENCE COL- LECTION IN OSTEOLOGY.

The question has at times been discussed whether the morphological museum should take its place in the university system as part of the departments of general biology and zoology, or as an integral division of the department of anatomy in the medical school. I am unhesitatingly of the latter opinion. Aside from the obvious relation to undergraduate medical instruction which I have attempted to outline above, the mere fact that man, the highest vertebrate of the series, forms the object of study in the medical curriculum, assigns to the morphological museum its logical place in the

university system. The human material necessary for the completion of the museum series is to be obtained from the supply of the medical school. The typical preparations are, of course, from specially selected subjects set apart for the purpose. Besides this, however, one of the important functions of the museum is to supervise the records of the dissecting room, to collect and arrange the statistical information afforded by the constantly repeated examination of the human body, to acquire for its own purposes the preparations which either illustrate normal structures unusually well or demonstrate important and significant variations. Part of this material is capable of direct incorporation in the museum series after removal from the cadaver and proper preparation. For other objects the method of plastic reproduction by means of casts is invaluable. This applies especially to the great group of myological variations. Not only are the objects bulky and not well adapted for preservation as moist specimens, but casts actually better serve the purposes of the museum in exhibition and instruction. In the comparative myological series, with which human muscular variations are necessarily brought into intimate relation, the method of plastic reproduction is an essential. The full utilization of rare and valuable animals requires this method because superficial structures must be removed before the deeper parts can be reached. As the superficial muscles are exposed casts of the different regions are taken in various positions. In the same way, by casting the deeper layers as they are successively reached, permanent records of the greatest value for myological study and reference are attained. The casts, together with the notes and drawings of the dissection, form a complete and readily accessible record far exceeding in value and accuracy any other method of illustration. Again, for example, in dealing with the development and modifications of the extremities in the vertebrate classes, each group is accompanied by casts of the entire hand and foot, forming, together with the preparations of the soft parts, muscles and ligaments and the skeleton of the extremities, a complete series. For purposes of instruction this method has proved itself very valuable. Thus a carefully prepared and hardened liver showing the natural surfaces and impressions, which are ordinarily lost in the organ removed from the body before hardening, and which are hence not ordinarily recognized, has been cast

and reproductions prepared in sufficient numbers to allow one to each student for personal examination during the demonstration of the organ to the class. This plan, when extended as purposed by the museum, will vastly add to the effect and value of our demonstrative teaching.

The development of the facilities for plastic reproduction of morphological objects enables the museum to enter into connection with other institutions for purposes of exchange and scientific intercourse.

In connection with the utilization of the human material for the museum I desire to mention briefly the Reference Collection in Osteology, as part of the plan of offering opportunities for extensive morphological and anthropological research. This collection includes:

1. The disarticulated skeletons of vertebrate animals.

These are kept in boxes, arranged like the books of a library, accurately catalogued and indexed, so that any desired skeleton can be immediately found and used. The collection is placed in the osteological laboratory. It is proposed to make the collection thoroughly representative, and to include sufficient individual specimens of each form to avoid erroneous deductions possibly based on unusual variations.

2. The department includes, in the second place, a reference collection of human bones, on a scale which renders possible a thorough comparative study in reference to racial character, variations, reversions, age and sex differentiations, etc. The collection is now approaching the limit which we originally designed for it, viz., 5,000 specimens of each of the bones of the human body, but will be extended beyond this point. I am gratified that this material has afforded one of our members, Dr. A. Hrdlicka, opportunity for some very interesting researches, some of which have already been presented to this Association, while his more recent results are to come before us at this meeting. The value of the collection is greatly increased by our system of record-keeping, which makes the material available for anthropological study in the widest sense. We obtain now, from the hospital records, the necessary data as to parentage, age, birthplace, etc., of each subject delivered at the college. These data are entered upon the record under a running number, which follows each bone on a lead tag through all stages of maceration and preparation until it is turned into the reference collection as finished. Conse-

quently this collection does not represent merely a catacomb of human bones indiscriminately packed together, but each bone, with its origin and history clearly indicated, becomes a member of a series available for scientific comparative work.

The same system is applied to all variations of the soft parts obtained from the dissecting room, and the variation collection of the general museum becomes in a like manner the means of promoting scientific inquiry into the causes and conditions at present operative in human evolution.

V. DEPARTMENTAL LIBRARY.

I may merely mention that a good working morphological library, containing the standard works and the more important current periodicals, forms part of the accessory equipment of the museum.

VI. LABELING AND CATALOGUE.

In conclusion I may briefly refer to the method of labeling and cataloguing the collection which we have found most useful.

The catalogue is divided into the *general* and *accession catalogue*. Each specimen as received is given an *accession number*. On the card slip, corresponding to the number in the accession catalogue, are entered all the data concerning the animal, as source of supply, date of receipt, weight of body and of individual parts, presumable age, sex, method of preparation, individual peculiarities, etc., and finally a complete list of the finished preparations derived from the animal as they are incorporated in the museum.

The general catalogue carries on each card the running number of the preparation and beneath the same the accession number of the animal from which the specimen is taken. It is thus possible, while avoiding needless repetition, to ascertain at once the details concerning any preparation by reference to the accession catalogue. The cards of the general catalogue are arranged in accordance with the serial exhibition of the museum. The running number of the general museum and the accession number appear on the label of each preparation. In addition the individual preparations carry two small disks of a bright color with a number. These are the complementary numbers of the preparation, referring it to some other group with which it is related, as well as indicating its position in its proper series. For example, the shoul-

der-girdle of the armadillo assumes its proper place in the series demonstrating the structure of this portion of the vertebrate skeleton, and is numbered accordingly on a green disk, so that its own place in the series is preserved, green being the color of that division of the museum which deals with the development of the pectoral and pelvic arches. If the armadillo's number in the series is 17, and an additional preparation enters the series next to it, it receives green number 17a, etc.

In addition to the green number a small red disk on the armadillo preparation carries a number which refers the preparation to its proper place in the series illustrating the general anatomy of the Edentates, red being the serial color of that division. So if it is desired to put together at once for comparison all the material contained in the museum for illustration of the Edentate type, every preparation carrying a red disk is taken out of its own series and the resulting group, when arranged in the sequence of the red numbers, forms the logical series treating of Edentate anatomy.

This plan makes every portion of the museum easily and at once accessible, and arranges the series in such a manner that each shall prove complementary to all the others.

By varying the shape of the colored labels and the character of the numerals sufficient range is obtained to meet all requirements.

In addition—as the series develop—more extensive type-written tablets are introduced, giving the general features of the group and indicating the purpose for which it was assembled.

Photographs and drawings of the preparations, carefully labeled, are used for indicating points of special importance, in such a manner that they can be readily identified in the actual preparation. These accessories prove of aid in the use of the museum for individual study and during informal demonstrations and conferences.

I have attempted to outline for your consideration the present status of the morphological museum and its relation to the system of the university. I am convinced that the practical value of the institution will continue to make itself more and more felt, and its general adoption and development will be one of the prominent features marking our educational and scientific progress during the next decade.

THE VALUE OF THE X-RAY IN THE STUDY AND DEMONSTRATION OF NORMAL ANATOMY.

BY DR. EUGENE R. CORSON, SAVANNAH, GEORGIA.

I have long felt that the X-ray would prove of value in certain lines of anatomical research, both human and comparative. Before we had the modern perfected coil and tube the value of the X-ray amounted to little, for only poor shadows of the bones were obtained; but, as the X-ray intensity became greater with a more perfect apparatus, the value of the method in the demonstration of normal anatomy was at once apparent. And as, without doubt, there is still much room for improvement of apparatus and technique, we can assuredly look for a still wider field of usefulness in the future. With the present X-ray efficiency at our disposal, its value is evident in the following lines of work.

1. In the study and demonstration of bone development, the growth of the epiphyses, the schema of their development, and the study of joints as joints, with their movements.

2. The demonstration of the internal structure of the bones

3. In the study and demonstration of the exact spacings and positions of the bones in the skeleton as a guide to its proper articulation and mounting. This would find its widest application in comparative osteology.

4. In the study and demonstration of the arteries on the cadaver where, properly injected, they can be skiagraphed in their absolute relations to other structures.

During this year I have devoted much time to the demonstration of bone development by this method, for it has a large practical bearing in its surgical application. Most of the skiagraphs which I present for your inspection have been reproduced in a paper which appeared in the November number of *Annals of Surgery*, on the membral epiphyses at the thirteenth year, and my excuse for showing you these prints is, that they are superior to the reproductions, and will give you a better idea of what we can expect from the X-ray findings. It is, perhaps, in this line of work that the X-ray will give us the greatest assistance, because we can really watch the bones grow, and there are many subtle problems of

bone development which may be solved in this way. Not only can we watch the successive steps in the growth and development of any one center of ossification, but we can get striking pictures of the several centers of ossific growth in the bones comprising a joint or member at the different stages of its progress towards perfected adult growth, that will enable us to take in this joint or member as a whole, a whole which will help to explain its parts.

This has been especially brought home to me in the demonstration of the elbow joint, perhaps the most difficult one to understand in its development, the complete understanding of which may solve many riddles of bone growth. The skiagraph giving a coronal view of the elbow, shows us in a very beautiful way the entire schema of its development, and I know of no one figure in any anatomy which reveals more of this joint. A series of skiagraphs equally as good at the different years of growth would simply tell the whole story.

I have found in my work that an ossific center not bigger than a pin's head could be made out, provided the bone could be brought close to the plate. My experience is that a good negative offers much for careful study, and details almost microscopic can be brought out by a magnifying glass. In the print giving a coronal view of the elbow the entire course of the nutrient canal of the humerus can be traced, and even more perfectly in the negative.

In the study of joint movements I have attempted to show the value of the X-ray in my paper on the movements of the carpal bones and wrist. Of course the wrist lends itself especially to this method, but I am convinced that other joints can be studied in this way, and much definitely shown which is still in doubt.

In the best skiagraphs we get a skeleton of the skeleton, we get the inner trabeculation and bony structure; and in the skiagraphs of the bones themselves, the negatives are most beautiful and show as much as good sections of the bones. In the study of museum specimens, for example, which cannot be mutilated, the X-ray will give us all the internal structure. A skull so skiagraphed will show us all the sinuses and bone-structure at the base, all the inequalities of the inner surface, the diploic structure, and the grooves for the meningeal arteries. I show you such a skiagraph, one, by the way, which is much improved upon, for it was done when I had less

experience in this work than I now have. In fact, on the living, we can get good outlines of all the sinuses, the *sella turcica* even, and thus measure the size of the *hypophysis cerebri*! A little thought will show us how certain other points of the skull can be made out on the living. We get thus a certain projection plan of the skull not obtained in any other way.

Another important feature of this work is the proper spacings and positions of the bones, revealed to us as they exist in the joints and in the groups of smaller bones, as in the carpus and tarsus. How many figures are given us in the textbooks where the bones are huddled together as in the articulated skeleton. In comparative osteology its value here must be even greater in giving us the true relations and arrangements of the bones, especially in the smaller animals, where the bones are so much smaller and their positions more difficult to estimate.

Another field but little worked up as yet, is the demonstration of the arteries, where the arterial trunks are injected with a substance which the X-ray can shadow. The Germans have done some work in this direction. We can get in this way skiagraphs of the arterial trunks, even up to the minutest arterioles, and in their exact relations to the bones, and even to tendinous and muscular landmarks, for much of the latter can be brought out by careful technique.

There is a certain mental drill associated with this work. From these bone-shadows the imagination is constantly building up mental pictures of the real bones. One is ever tallying the substance with the shadow. And these shadows are so different from the two-dimensional shadow of ordinary light. The X-ray shadow is a translucent one, so to speak. There is a perspective to the picture, and the bone shadows stand out like the real thing, with contrast, and depth, and the most delicate shading. The good negative is like an etching, and the better the negative the more this etching effect comes out in the print. My X-ray work has given me vivid mental pictures of the bones that I never had before. It has given a new interest to what had become familiar and commonplace.

As the acid eats out for us the earthy salts of the dead bone, leaving the animal matter, the X-ray eats out for us the an-

imal matter of the living bone, revealing the earthy framework in all its beautiful detail.

My friend, Prof. S. H. Gage, of Cornell University, had my prints made into transparencies for the stereopticon, and the pictures were brought out on the screen in a very striking way with all their detail and contrast, and I think it was the general opinion of those present that the demonstration of bone development at least could be made most instructive by this method. This subject does not enter much into the course in anatomy, and few students leave College with much knowledge of the subject, although it has a real practical bearing from a surgical standpoint. One or two lectures in the course so illustrated could be made most effective in a didactic way, and I have no doubt that this method will be so utilized.

THE LEVATOR ANI MUSCLE.

BY DR. EDMUND W. HOLMES, PHILADELPHIA.

If we trace the transversalis fascia downwards over the pelvic brim, we will find it continuous along the outer pelvic wall, in its attachments, to the margin of the sacrum and coccyx, to the tuber ischii and rami of the ischium and pubes, and anteriorly it spans the triangular space of the vesical triangle to join its fellow of the opposite side, subtending the subpubic membrane, forming the so-called posterior layer of the triangular ligament. Thus regarded, the fascia is wholly parietal, shutting out from the pelvic lumen the pyriformis, the obturator and the compressor urethrae muscles, and affording practically a mesial sheath for these muscles.

Internal to the fascia, on a line from the posterior surface of the crest of the pubes, to the spine of the ischium, our muscle arises from the face of this parietal fascia, from which also a fibrous leaflet projects proximal and distal to the levator ani, running downwards and inwards parallel to its muscular fibers, being called, respectively, the recto-vesical and anal fascias, but for our present purpose merely forming a sheath for this muscle, and in reality constituting the true supporting floor of the pelvic outlet.

The levator ani in its origin is unique. At its extremes, two small, bony points, and the rest, "the white line," all membranous. Powerful as its fibres are and important its function, I can think of exactly no such origin for any other muscle in the body. Its insertion also is fixed, only at the perineal center and the coccyx, while at the median raphé, movable, though counterbalanced by its fellow of the opposite side, and at the sphincters is as yielding as the soft viscera themselves.

Its peculiar attachments indicate a more varied function than its name implies, while its muscular layers are amply exercised, in affording a flexible floor for the pelvic viscera, which is influenced by each respiratory movement. In fact every practical operating gynecologist watches the breathing

movement of the perinaeum and feels the pulsation of the adjacent arteries, so that with the vascular beat and the respiratory rhythms at hand, he should not be entirely ignorant of the aetherized status of his patient.

The muscular fibers of the levator ani are distributed in a series of curves, arching downwards and inwards, those from the pubes extending posterior to the prostate. I cannot find that any part of this muscle is actually attached to this gland, only the fibrous sheaths coalescing, but the muscular fibers go behind it to conjoin with the opposite muscle, constituting a compressor as well as a levator prostatae. The radiations from the "white line" go directly to the perineal center and the sphincter ani, and to the sphincter vaginae in the female. We cannot trace muscular fibres to the walls of either of these canals, as again only the fibrous capsules are continuous. In fact, the upper edge of the levator ani can be traced to the edge of the sphincter ani, to that of the sphincter vaginae, the main support of both of these columns being the rectovesical fascia and not the muscle. In the interval between the prostate, rectum and coccyx and in the corresponding parts in the female, the levator ani meets its fellow of the opposite side.

The architectural plan of the pelvis is that of an ellipse; roughly speaking, the inlet and the outlet of the true pelvis may be regarded as two ovoids almost touching at the symphysis, widely separated by sacrum and coccyx behind, with "Carus" curve as the axis or stem.

The bladder with its urethra curves downwards and then forwards to emerge anteriorly; paralleled by the vagina, and then by the rectum, though later the anal canal curves away almost in the opposite direction.

The vagina was never intended to be a straight canal, but curves forward. In the erect posture, the weight of the abdominal viscera is thrown upon the symphysis and the upper circle of the bony arch, the fundus of bladder and uterus having a similar direction; the rectum curves parallel to the uterus following the hollow of the sacrum. The whole mechanism, I need hardly say, showing in the female, nature's intention to direct the foetal vertex under the pubic arch, the curve of the sacrum, the inclined plane of the pyriformis and of the obturator internus also having this tendency.

The fibers of the levator muscle are practically, therefore,

arranged in concentric layers, none of which are directly inserted into the vaginal or rectal walls.

The recto-vesical fascia which forms the proximal side of the muscular sheath blends with the fibrous coat of each canal. But the only direct interlacement of muscular fiber is with the sphincters.

By contraction the levator ani antagonizes the sphincter and thus opens the orifice of the vagina or rectum, while the remaining fibers attached to the median raphe, may in conjunction with its fellow, compress each canal and coapt the posterior to the anterior wall slightly, but such action must be very slight, it more likely acting as a tensor to the fascia. For this double function we find a sure sign—a double nerve supply—the inferior hemorrhoidal and the fourth sacral, and in further confirmation the latter nerve (fourth) supplies the compressor urethrae, which is also compressor in function. Similarly, as a result of its insertion into the vaginal sphincter, its fibers have only an indirect relation to the vaginal outlet by keeping the fascia tense, and to a slight degree coapting the posterior wall against the anterior. In parturition, therefore the vaginal sphincter tear is immaterial, but laceration of the supporting fascia a very serious matter.

The origin of our muscle being admitted, we concern ourselves, then, more particularly with its insertion. It would seem as if the authors are in error in asserting that the levator ani is inserted "into the lateral aspect of the prostate," "into the side of the rectum" or "into the walls of the vagina;" but, like its origin, the muscle is attached to a narrow linear insertion, the median raphe and the two sphincters. Probably through the fibers supplied by the inferior hemorrhoidal antagonizing the sphincters, at the same time rendering tense those inserted into the median raphe, while through these fibers encircling the bladder and prostate, or in the female the vagina, and supplied by the fourth sacral, it compresses these organs.

It is more a tensor of the fascia either at its origin or insertion, the fixed point being interchangeable, so that it should be called "tensor perinei" rather than "levator ani."

THE USE OF WET SPECIMENS.

BY DR. EDMUND W. HOLMES, PHILADELPHIA.

The purpose of this paper is not ultra scientific, but argumentative and evangelistic, because (1) among the general public and among many of our profession the great cry is practicability, *i. e.*, the doctor must be able to use that which he knows, and, knowing it, must be able quickly to transform it into gold; because (2) our medical schools are advocating the scientific idea—science and knowledge for its own sake—and, strangely enough, in the sectarianism of the laboratory are endeavoring to train their pupils to be scientific before they have been educated as physicians. We most thoroughly endorse the sentiments of Prof. Dwight, expressed at the last annual meeting in New Haven, in opposition to excessive student experimentation.

As a resultant of these two forces, our medical schools are getting away from their original intent of turning out practicing physicians, but in their stead are evolving one-sided specialists, which the tendency to laboratory and section teaching only seems to increase, by compelling men to choose a certain subject or two, which shall, perforce, occupy the greater part of their attention, to the disadvantage of the rest.

A good plan badly carried out is fatal to its efficiency, and laboratory or section work which (needlessly) tends to a narrow specialism in the undergraduate years, backed up by popular clamor for immature specialists and an undue desire for quick financial returns, is really worse than the old system of seven fundamental branches, of intelligent breadth of instruction, in *all* of which the graduate must be reasonably proficient.

From this attitude of utilitarianism and specialty has arisen a disregard of the fundamental branches and an impatience of the toil necessary for their acquirement, particularly in regard to human anatomy, which is ill concealed even by some in authority.

Let me quote two remarks that I have heard of as coming from two well known scientific anatomists—

(1) "There is nothing new in human anatomy; it is all in the books."

(2) "A man who has a book, a subject and a scalpel ought to be able to work it all out for himself"—
two as damnable heresies as ever were anathematized in a papal bull.

Following this has come a neglect of teaching method, so that in many instances the arrangements for instruction in anatomy are no better than they were twenty-five years ago.

One of the most obvious improvements is the teaching of anatomy in small sections, which has not been put in practice in the dissecting room for want of time, because the roster is overcrowded with subjects that belong more properly to the post graduate work and because it requires an increase in the corps of instructors.

Next to small numbers is the methodical apportionment of the work. There is no reason why on a certain day, in chemistry the class should work on certain elements, or in physiology on certain reactions, or in histology on certain tissues, while in dissecting it is a "hop scotch," "happy-go-lucky," "go as you please." If it were possible, we would not only assign the same dissection for the same section hour, but we would have the scalpels ply together, with the same unison as the violin bows in a well trained orchestra. If the task for the period is the deep fascia of the thigh, it would be a delight at the end of the hour to go around the room and see it thoroughly defined on every cadaver, with its subdivisions, its saphenous opening and the superficial veins and nerves lying neatly in view.

To be ahead of the assignment is a crime, to be behind is far better if it implies not sloth nor ignorance, the most careless students being the most rapid slashers.

Methodical and trim dissection implies a foreknowledge of the structures, exacting preparatory work at home; but it is difficult to impress the fact that the dissecting room is a laboratory and not a library alcove. Didactic reading should be done at home, the only use of the book here being in connection with the cadaver.

We would mark "absent" those who are away from their "part" for any considerable interval longer than to ask a

question, glance at a skeleton or examine briefly another dissection.

We would not allow students to cluster around tables not their own; it is usually an excuse to escape work.

Upon each subdivision, head, arms, &c., once a week a demonstration should be given showing the structures to be dissected out, and the assistant in charge should be expected to see that his students do that work, and may aid them individually, but should not in any way, by demonstration or otherwise, draw men from their work at other tables. In other words, the whole emphasis of the dissecting room should be upon the dissecting, and not upon the loafing, the telling of stories, the eating of lunch, or even the reading of anatomy. In place of the text book should far more usefully be provided the wet specimen and the explanation of the teacher. Further, as I have said elsewhere ("Medical Education," p. 10);

"Human bodies are too costly and too sacred to be used to teach novices the elementary principles of the dissecting art, such as how to take off skin or fascia, or how to clean up the insertion of a muscle. It can just as readily be done upon the cat or the rabbit. A student should not be allowed to touch a human cadaver till he knows how to dissect, and has been drilled upon a wet dissected (human) specimen to learn what to look for."

Knowing first, then, what to look for, the wet specimen of muscle, artery or joint should be kept continually before him as a pattern from which to work. We find a good dissection stimulates to good work; and upon being shown a structure clearly defined the student is the more ready to work it out for himself.

We all know it is not always possible to show everything on one part. This defect is also supplied by a wet subject; neither are the deeper connections given us at a glance, though they can well be indicated by the accessory dissection. Further, in the exhibition of deeper structures the more superficial must be cut away, but in the review they may be seen again in the permanent preparation.

At the conclusion of the dissecting period, several days should be devoted to review, when demonstrations may be given by all the table assistants, stopping at the point where the student "lays down upon the instructor;" such reviews

being imperatively on the cadaver and not "didactic" nor from the book.

One of the aggravations in a demonstrator's life is the alumnus dissector. He has graduated under the old regime; finds, to his sorrow, his weakness in anatomy, the lack of which there is nothing that he regrets more; so he comes back and says he has forgotten his anatomy (in reality he cannot forget it because he never knew it, if for no other reason than as a student he dissected the body only once, and no child could learn a simple puzzle that way), and declares he returns to his *Alma Mater* firmly determined to learn it—in a week. He "cares not for details and only wants the main facts." "How many parts can you give me?" "All you want!" "Well, send me up a leg." As he has taken a whole week off from practice to come to the city, he must see some of the performances of the theaters at night, and also some of the clinics by day, for of course by this time he is a specialist, having studied abroad six weeks, of which two were on the ocean.

After two days' work he becomes tired of the tedium of dissecting, and if he is allowed, he will ligate the arteries, amputate the extremities, and operate on the appendix, thereby precipitating an epidemic of similar operative procedures among the student body.

For such hurried practitioners we unqualifiedly recommend the wet specimen. With a book on applied anatomy, with the dissected subject before him, he can get ten times more practical benefit than he can by the hurried, untidy labors of his own hand.

Thus for both student, graduate and teacher the wet specimen is most admirable, enabling of rapid review upon a series of preparations far more elaborately and completely worked out than could possibly be accomplished by the individual not an expert.

In the average medical curriculum there are apt to be two great humbugs, the clinic and the dissecting room; that is, the large clinic where you see nothing, and the large dissecting class where you do nothing. If we were given the choice, with the average student, between a course of study upon the cadaver, with carefully prepared wet specimen, and the average hacked-up dissection, we would without hesitation recommend the former. Therefore for intelligent comprehension based on sound pedagogical principles, instruct your student first as to

what to find and where, "in the wet," and then careful, neat, systematized dissection cannot be done too often.

For the preservation of the wet specimens the cold storage is by far the best. Alcohol hardens them; a solution of chloral waterlogs them; formalin preparations favor mold as soon as the fluid is allowed to evaporate. Even the Kaiserling fluid permits of this if the specimen is not kept thoroughly immersed. But, outside of permanent jar preparations, those which are to be handled had better be kept in storage and can be thus used from year to year.

In the coming by and by, when the importance of the dissecting room is recognized, there will be a cold storage plant for this purpose adjacent to it. More and more, in the old museum, its musty jars will be relegated to desuetude, and specimens to be handled by the student will be abundant and within reach.

Human anatomy is the most difficult branch in the curriculum; the student entering without biologic training, and, perhaps, with it, is but a kindergartener, and should be taught at first as in the kindergarten, by models and specimens, taking apart and putting together, till he learns whereof he knows, and then he should dissect.

TYPICAL FORMS OF SHAFT OF LONG BONES.

BY DR. ALES HRDLICKA, OF NEW YORK CITY.

[Abstract.]

The paper presents the further results of the author's investigations of Prof. Huntington's osteological collection in the Medical Department of Columbia University, New York City. It deals with the variations in shape of the shaft of the long bones of the human skeleton and with classification of these shapes. The first part of these studies, dealing with the typical shapes of the shaft of the tibia, was presented before the Association in 1898.

There have been examined so far the long bones of 1,200 skeletons of whites, 40 skeletons of negroes and 100 skeletons of Indians.

Each variety of the long bones presents more than one typical shape of the shaft. The form is best differentiated at or near the middle of the bones, in adult individuals.

Variation in the shapes is greatest in the whites. There are considerable racial differences in the absolute as well as relative frequency of the different forms of shaft of the various bones; no one type, however, occurs exclusively in either of the three racial groups examined.

The bones of the lower extremity show somewhat more numerous differentiations of form than those of the upper extremity. Of the individual long bones the fibula shows the greatest variety of shapes; then follow, in the order named, the tibia, femur, humerus, ulna, radius.

Perfect representatives of the various types of form are found when larger collections of bones are examined; less perfect but clearly distinguishable types are more common. Besides these a considerable percentage of bones presents intermediary, and a smaller proportion combined, forms.

The fundamental form of shaft in all the long bones is the prismatic (No. 1). The outline of the cross-section of a shaft of this type approaches closely the equilateral triangle. This type of long bones is common in apes and, more or less modified, in lower mammals. The base of the prism is formed in

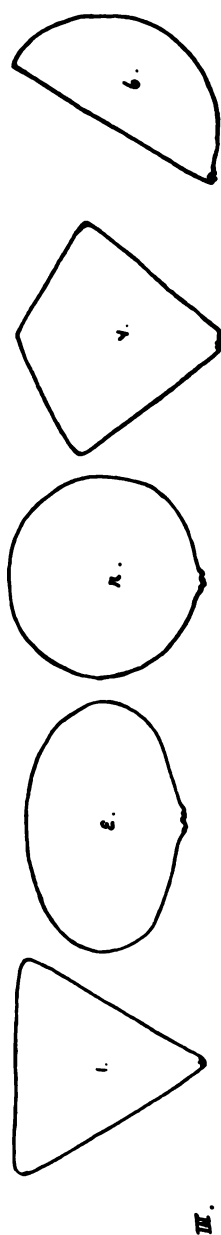
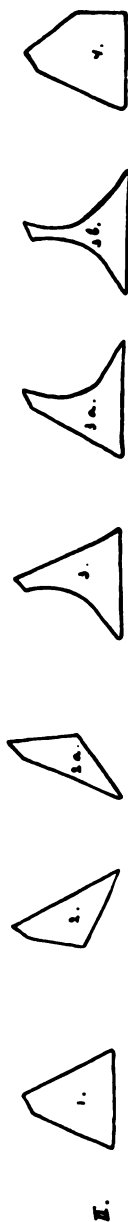
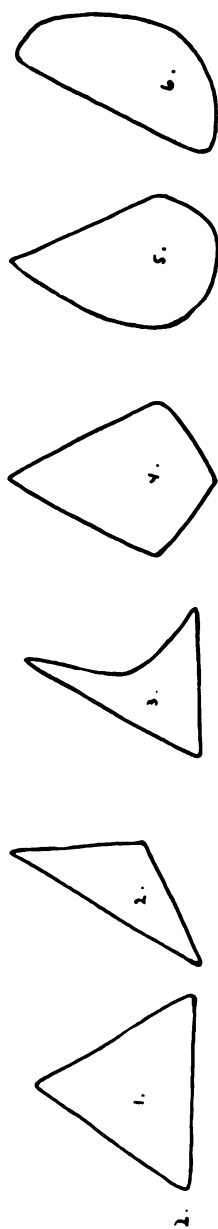
the tibia, fibula and humerus by the posterior; in the femur by the anterior; in ulna by the internal, and in radius by the external surface of the bone. In whites this type of shaft is most frequent in the humerus. In the fibula it is slightly modified by the anterior surface of the bone.

The nearest modifications of type 1 are types of shaft Nos. 2, 2*a*, and 4. Types 2 and 2*a* occur principally in the tibia, fibula and humerus; and are characterized by the obliquity of the posterior surface of the bone. Type 4 occurs in all the long bones, and is characterized by the presence of a distinct additional surface on the shaft. The formation of the surface differs in the various bones. In the tibia the additional surface results from a division into two, by a vertical ridge, of the posterior surface; in the fibula a duplication is observed on the external surface; in the femur it is the anterior, in the radius the external, and in the ulna the posterior surface, which occasionally, through the influence of a vertical ridge, shows a formation of a distinct additional plane; in the humerus, finally, a new, anterior surface results occasionally by the broadening out of the anterior border of the bone.

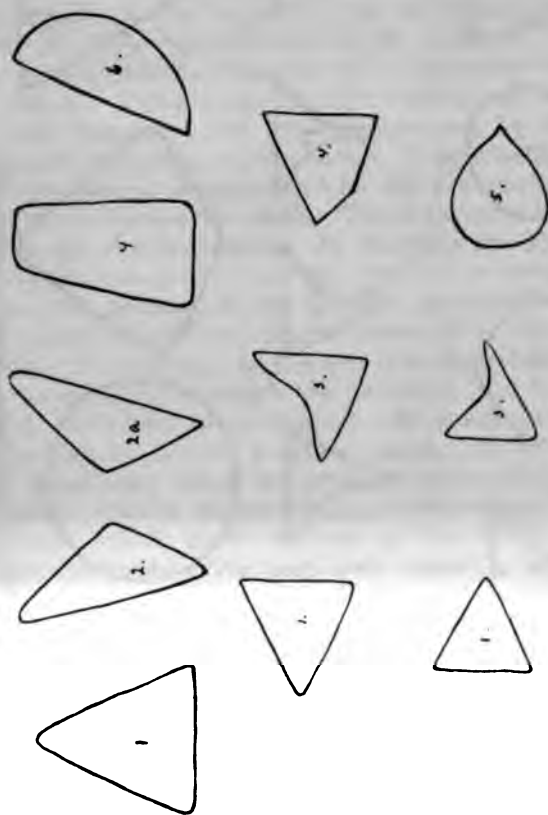
A special class of modifications of the form of the shaft is that where one or more surfaces of the bone show a pronounced concavity. We find such types (3, 3*a*, 3*b*), particularly in the fibula, but also in the tibia, ulna and radius. In the fibula the concavity affects especially the external, but also the internal, and occasionally both the external and internal surfaces; in tibia the character is observed on the external and in the ulna and radius mainly on the anterior surface.

Types 5, 6, *c*. and *r*., are widely differing forms of the shaft of some of the long bones; all these types have, nevertheless, two features in common, and that is an indistinctness or complete obliteration of one or more of the borders of the bone and marked convexity of two or all the surfaces. They approach more or less the infantile types of the bones.

Type 5 occurs occasionally in the tibia and frequently in the radius. It is marked by the convexity of the posterior tibial and external radial surface and by indistinctness of the internal and sometimes also the external border in the tibia and the anterior and posterior borders in the radius. In both bones, but particularly in the tibia, this type of form represents a deficiency in the differentiation of the bone.



Typical Forms of the Shafts of Human Long Bones (bones of the left side).
I. Tibia ; II. Fibula ; III. Femur.



Typical Forms of the Shafts of Human Long Bones (bones of the left side).
 IV. Humerus; V. Ulna; VI. Radius.

IV.

V.

VI.

Type No. 6 occurs in the tibia, femur and humerus. The shaft is plano-convex. The type is much more frequent in negro tibiae and Indian humeri than in these bones in the other races here considered. Types *e* (elliptical) and *r* (round) are found in the femur.

The condition of flatness in long bones occurs quite independently of the shape otherwise of these shafts. Flatness is not only found in the tibia, but also in the fibula (lateral), femur (antero-posterior of whole shaft, and, independently, antero-posterior of the upper part of the shaft, below the minor trochanter) and humerus (lateral). Flatness of the long bones is most frequent in the Indians, least frequent in the negroes. The flat femur (whole shaft) occurs almost exclusively in whites and independently of the flatness of other long bones. A flat tibia is often accompanied by a flat fibula.

CAUSES OF THE VARIOUS SHAPES.

(a.) Stage of life: Exceptionally a clear type of one or more of the shafts of the long bones is found in an infant. The ultimate stage of differentiation of the shape of the shafts of the various long bones is apparently reached in some individuals during adolescence, but in the majority of cases probably not until during the first part of the adult life. Senility seems to have no effect on the shape of the bones.

(b.) Sex: Excepting individual cases, the male bones show more differentiation in shapes than the female.

(c.) Race: The whites show more differentiation in the shapes of the long bones than the Indians, and these show probably a somewhat greater variety than the negroes. Shapes frequent or not uncommon in one race (6 in negro tibiae, 4 in Indian humeri) may be rare in the others.

(d.) Size of the body: The longest and the shortest bones of any variety show in general less differentiation than the intermediary sizes. Weak bones show on an average less differentiation of shapes than stronger ones.

(e.) Pathological conditions: Curvatures of the tibia, particularly the outward curvatures of the upper half or third of the bone, accentuate the concavity of the external surface. Curvatures also influence the shape of the fibula, femur and ulna.

(f.) The occupation of the individual undoubtedly exercises

an influence on the shape of his bones. This subject, which is very complex, is under investigation.

(g.) The sum of the observations thus far concluded, points to the fact that the principal causes of the various shapes of the shafts of the long bones must be sought for, first, *in original differences in the attachment of the various muscles on the shafts*, and, second, *in an unequal development and work of these muscles during childhood and adolescence*. The original differences in attachment, some of which can be clearly demonstrated on the bones, will probably be shown to be partly hereditary, partly anomalous conditions. The manner in which the differently attached or differently developed muscles affect the shapes of bone must evidently be largely if not entirely mechanical.

Investigations continue in this direction as well as those concerning the concurrence of the different types.

The studies of the various forms of shaft of the human long bones lead to the following two generalizations:

(1.) The various forms of shafts represent possibilities of results of our present anatomical peculiarities and our present activities.

(2.) The greater range of variation of the forms in the whites than in the Indian or negro, corresponds to and is the result of the greater variation of activities among whites and probably also of inborn characters such as defects and surfects of muscle-insertions.

Investigations of the bones of whole families, or of persons related through much intermarriage or through some definite occupation practiced for several generations, are very desirable.

As to the tendency of the diversification of the forms of the shaft of the long bones, only possibilities can be spoken of. The variation of shapes may further increase. As to an evolution of any new type of skeleton, there can not be much expectation of such an event so long as activities diversify and mixture is great. Should, however, any definite class of activities continue to preponderate, either in some more isolated community or generally, it is logical to suppose that the type of bones most adapted, that is, presenting the least resistance, to those activities, would show a gradual augmentation.

CONTRIBUTION TO THE OSTEOLOGY OF RIBS.

BY DR. ALES HRDLICKA, OF NEW YORK CITY.

[Abstract.]

The material examined consists of 1,000 first, 1,200 second and 14,000 other ribs of Prof. Huntington's collection, and the ribs of numerous Indian skeletons in the American Museum of Natural History, New York City.

THE FIRST RIB.

(a.) This rib shows considerable differences both in size and shape. Two varieties of shape can be distinguished: the ribs of the first variety are nicely curved and almost semicircular in outline; the ribs of the second variety show in their course one or two distinct angles.

(b.) The "scalene" tubercle, or, rather, spine, was found as follows:

	<i>Per cent.</i>		<i>Per cent.</i>
Completely absent, . . .	9.5	} Approximately, .	30.0
Mere trace,	21.0		
Present, various sizes, . .	69.5		
		—	Approximately, . 70.0

In 2.0 per cent. of the ribs a distinct double spine was found.

The formation of the spine seems to be partly due to the mechanical effect of the contact of the subclavian artery with the first rib. The exact significance and formation of the spine needs further investigation.

(c.) On the superior surface of the first rib, near its sternal end, on or near its ventral border, there exists in 16.5 per cent. of the cases a distinct and occasionally prominent tuberosity, with an articular or, rather, a *contact* facet for the clavicle.

(d.) The cartilage of the first rib ossifies earlier than any other rib-cartilages; it also ossifies in another manner than most of these. In other ribs than the first, and possibly the second, the ossification of the cartilage proceeds, especially in one or both borders, on the surface, irregularly from one or a few points and the bone extends gradually over most of the

cartilage, showing none, or but very irregular interruptions or defects. On the cartilage of the first rib, the bone forms generally in more or less irregular, concentric segments. There are ordinarily three, four or five such segments, and they join by their serrated borders. Each segment may consist of several pieces of forming bone.

In rare cases the ossified cartilage of the first rib becomes united to the sternum; this process may possibly be influenced by some pathological condition.

(*e.*) A number of first ribs were found showing one or two pronounced deformities on their superior surfaces.

THE SECOND RIB.

(*a.*) The bone differs in size as well as shape. In shape there is a tendency to an angular form, the angle being situated at the tuberosity, but the modification is not as plain as in the first rib and not pronounced enough to constitute a distinct type of the second rib.

Pathological (rachitic) influences are more manifest on the second than on the first rib; they affect mostly the sternal extremity of the bone.

(*b.*) The tuberosity of the second rib is subject to much variation; it is almost absent in some and very pronounced in other specimens.

Anteriorly to the tuberosity, we find occasionally a more or less pronounced notch on the external border of the bone.

(*c.*) The ventral border of the second rib presents in some cases, in a location corresponding somewhat to that of the "scalene" tubercle on the first rib, one or two distinct small spines or tubercles. More frequently we find in this location a roughness or a dentation of the border.

RIBS BELOW THE SECOND.

In health, the fourth to tenth ribs show comparatively but little variation in form. The third rib, particularly its sternal half, is more subject to modifications. The eleventh and twelfth ribs differ much more in size than in shape. Occasionally the anterior extremity of one of the longer ribs will be unusually broad, or, again, tapering. In some cases a part of the inferior border of the rib shows an unusual development, and in others the head is much broadened.

The results of pathological (rachitis) and mechanical influ-

ences on the ribs from the third downward are quite frequent and apparent in whites; no deformities of this nature were found in the ribs of Indians.

NOTCHED RIBS.

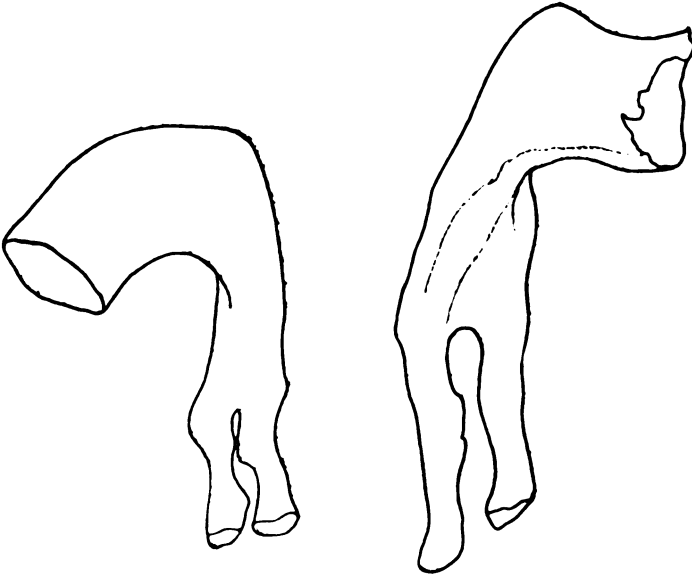
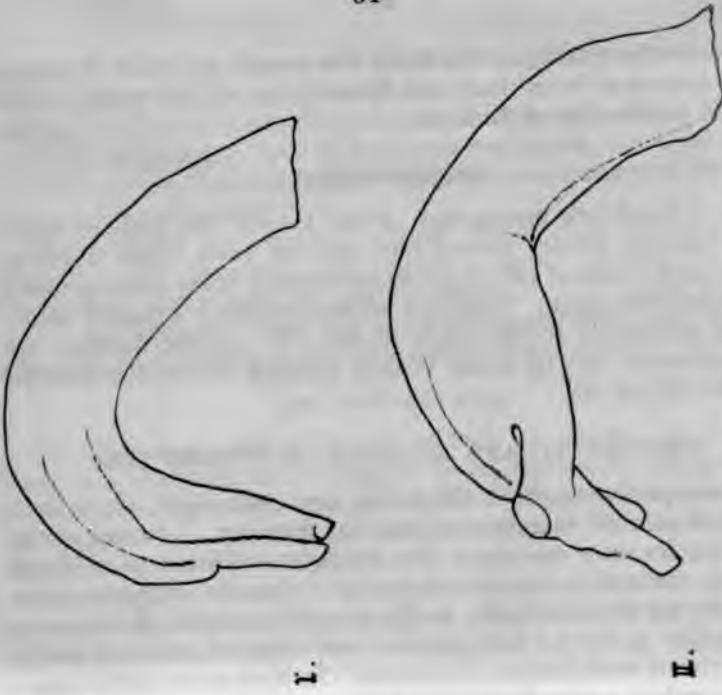
In a moderate percentage of the longer ribs (4th to 10th) the inferior border shows one, two or even more notches. The notches are of varying size and depth; some form as much as a half-foramen. They are most frequently situated somewhat anteriorly to the angle of the rib. These notches are undoubtedly due to blood vessels passing across the inferior border of the rib.

PERFORATED AND BICAUDAL OR FORKED RIBS.

Two specimens, both third ribs and both right, show each in their sternal extremity a vascular foramen. In one of the ribs the foramen measures five by eight millimeters in diameter, is situated in the sternal border of the ribs and encroaches slightly on the cartilage; in the second specimen the foramen is smaller (2 by 3.5 millimeters) and situated one centimeter from the sternal border of the ribs. In both cases the foramen is somewhat nearer the superior than the inferior border of the rib; and in both cases the sternal end of the rib is somewhat broadened. It is possible that in these two specimens we have an indication as to the mode of causation (vascular obstruction in the path of the ossification) of at least some instances of the bicaudal or forked ribs.

Among the 14,000 ribs other than the first and second there are six specimens that show a forking of the sternal extremity; besides these there is one among the 1,200 second ribs that presents a considerable broadening of its sternal extremity and two articular facets on the same. In the longer ribs the forking extends from one to five centimeters from the sternal border. The forks diverge somewhat except in one specimen, where they run parallel. In all the forked ribs the sternal extremity is broadened, and this broadening extends usually considerably beyond the division. The two branches differ in all the specimens in breadth as well as in length. In all the cases the superior branch is the narrower and shorter (compare the perforated ribs).

Four of the bicaudal ribs are right and one left. Two, pos-



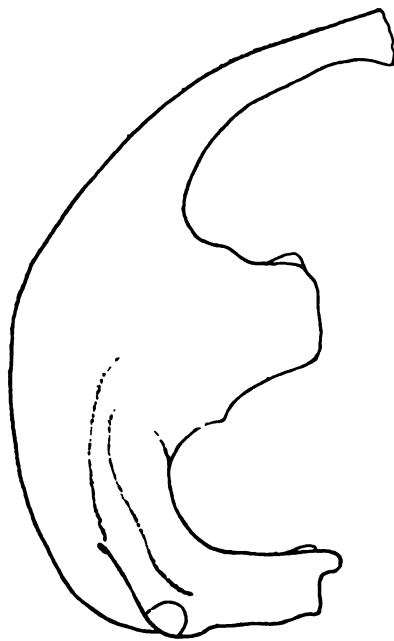
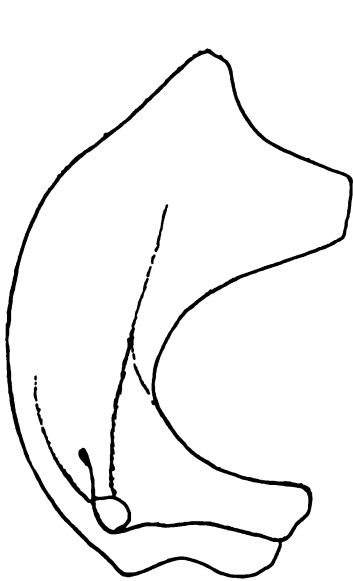
I. II. Specimens showing a Fusion of the distal extremity of a Cervical with the body of the First Rib.



III.



IV.



III. IV. Specimens showing a partial, marginal Fusion of the bodies of the First and Second Ribs.



V.



VI.

V. Specimen showing a Fusion of the distal extremity of the First with the body of the Second Rib.
 VI. Specimen showing a partial, marginal Fusion of the bodies of the Third and Fourth Ribs.

sibly three, of the right ribs are the third; one, at most two, the fourth; the left specimen is apparently also the fourth rib.

The bodies and heads of the forked ribs are normal with this exception: In one of the specimens the non-articular part of the tuberosity is very prominent. In one (the same character is also present in both of the perforated ribs, and undoubtedly has no connection with the anomaly) this part of the tuberosity is surrounded outwardly by a marked exostosis.

Several upper thoracic (3d, 4th) ribs were found showing a marked broadening of the sternal extremity, but no division of the same.

BICIPITAL AND FUSED RIBS.

Among the 1,000 first ribs there are four joined specimens; and I have found two similar specimens among the Indian ribs examined.

Only two of these six specimens are alike in their features, and five times out of the six the anomaly has occurred on the left side.

In two of the six cases we have a junction of a cervical with the first rib, in three a junction of the first with the second rib, and in one case a junction of the third with the fourth rib.

In both cases of the union of the cervical with the first, and in one of union of the first with the second rib, the more superior rib descends to the more inferior one and is fused with this; the sternal part of these specimens shows no abnormality. These are true bicipital ribs.

In the remaining three specimens the anomaly consists in an extension and more or less extended fusion of the neighboring borders of the ribs. In these cases we have seemingly a combination of a bicipital and bicaudal rib; the production, however, of the bicaudal condition in this and the variety of ribs previously described differs radically.

The fusion of ribs seems to be wholly restricted to the upper part of the thorax.

DIFFERENCES BETWEEN THE RIBS OF THE TWO SIDES.

A set of ribs from a skeleton is demonstrated. Beginning with the fourth rib, the bones on the two sides show very considerable differences in strength and shape of the body, not due to curvatures. The 11th and 12th ribs differ remarkably, the more superior ribs slightly, in length.

Less marked differences in the shape, strength and length of the ribs of the two sides are common in both undeformed and deformed thoraces.

ARTICULATIONS BETWEEN RIBS.

Occasionally, after a fracture of a rib, there is a development, from the callus, of a bony process which reaches to the adjoining rib, or meets a similar process sent from this, and the process and the rib or the two processes form an articulation.

In one instance, in the skeleton mentioned in the preceding paragraph, there are well developed articulations between four ribs on each side (8th to 11th) without there having been any fracture. The articular facets are slightly elevated; they are situated near the angle of the ribs, and have undoubtedly resulted from a close apposition and at least an occasional contact of the dorsal thirds of the bones.

FRACTURES OF THE RIBS.

Among the whites, fractures were found in four per thousand (1 in 125 skeletons) in the first rib; twenty per thousand (1 in 25 skeletons) in the second rib; and fifty per thousand (1 in each, or 3 in every third skeleton) in the ribs below the second. In Indians, fractures of ribs are very much more rare * (and the same seems to be the condition in the negro, but there were not enough negro ribs to permit a definite statement).

The fractures were :

Single in 77.4% (right, 39.4, left, 38.0 %).

Double in 19.0 " (right, 9.4, left, 9.6 ").

Triple in 3.2 " (right, 1.6, left, 1.6 ").

Quadruple in 0.3 " (right, 0.15, left, 0.15 ").

The situation of the single fractures was as follows :

In the head, right, 0.3 % left, — %

Between head and angle, right, 2.9 " left, 2.1 "

At the angle, right, 8.4 " left, 9.0 "

At or in the posterior third of body } right, 21.0 " left, 18.8 "

At or near middle, right, 17.5 " left, 26.0 "

At or near anterior third, right, 21.5 " left, 23.0 "

Near the sternal end, right, 6.1 " left, 3.5 "

Curvatures and pathological conditions of the ribs will be described later.

* Among 1480 ribs of the ancient cliff dwellers in Southern Utah, only four, or 2.7 per thousand were fractured.

PRELIMINARY REPORT WITH PROJECTION DRAWINGS, ILLUSTRATING THE TOPOGRAPHY OF THE PARACŒLES IN THEIR RELATION TO THE SURFACE OF THE CEREBRUM AND CRANIUM.

BY EDWARD A. SPITZKA, NEW YORK CITY.

(Illustrated by drawings.)

[Published in the *New York Medical Journal*, Vol. LXXIII, February 2, 1901.]

[Abstract.]

The operations of tapping, draining and injecting the paracœles, as the lateral ventricles are to be designated, have become recognized surgical procedures, both for diagnostic and therapeutic purposes. The mode of procedure, however, is yet far from technical completeness, and consequently these operations are not frequently resorted to, owing to the surgical risks and topographical uncertainties. The writer believed that reference plates giving reliable and clear representations of the cerebral and cranial relations of the paracœles were a desideratum. The otherwise excellent plates of Fraser, like most photographic plates, especially if composite, lack the clearness so essential for busy, practical men. A search of the literature made by the writer reveals three attempts essaying to depict such topography: by Poirier, in France, Wilson, in England, and Quain (source unknown). They are all unavailable for surgical use.

The results here offered are of a preliminary nature only, and so far are based upon the dissections of two heads of adults, for which material I am indebted to Prof. Huntington and Dr. B. B. Gallaudet, of the Medical Department of Columbia University.

For the illustrations the reader is referred to the fuller account published in the *N. Y. Med. Journal*, as cited above.

A PRELIMINARY COMMUNICATION OF A STUDY
OF THE BRAINS OF TWO DISTINGUISHED
PHYSICIANS, FATHER AND SON.*

BY EDWARD ANTHONY SPITZKA, OF NEW YORK CITY.

Student of Medicine, College of Physicians and Surgeons.

[Reprinted, with a few additions, from the *Philadelphia Medical Journal*,
April 6, 1901.]

To a great extent, the more recent studies of human brain anatomy may be termed one-sided, inasmuch as the numerous examinations made of individual cerebra were of such derived from criminals, lunatics, and other defectives, nay, most frequently from subjects whose life history and characteristics were and remained unknown, or were unworthy of record. On the other hand, the brains of public men of professional or scientific eminence, whose actions and attainments were "writ large upon the pages of history" are seldom obtainable. In the words of Wilder, this is "both illogical and unprofitable. * * * It is at once a reproach and an irreparable loss to science that the community has not yet been convinced that the preservation and study of one's brain is an honor to be coveted. Who can set a limit to the result that might have been attained from the examination of the brains of soldiers like Grant, Sherman and Sheridan; of preachers like Beecher, Brooks and Howard Crosby; of naturalists like Agassiz, Gray and Jeffries Wyman; of lawyers like Tilden, Conkling and Benjamin Butler. How long must science wait for a general sentiment such as is embodied in the declaration of an eminent historian, that science is as welcome to his brain as his old hat, and that he wishes he had ten of them."

To this day only a few brains of eminent men have been studied and described: among these may be mentioned that of Chauncey Wright, a philosophical writer; of George Grote,

*Read also, by invitation, before the Section on Anthropology and Psychology, New York Academy of Sciences, February 15, 1901. In view of a monographic study, the publication of which is contemplated, the writer refrains from an enumeration of those details essential to the latter and whose reproduction were unnecessarily repetitious.

the well-known historian of Greece; Hugo Gylden, the astronomer; Prof. von Helmholtz, physiologist and physicist; Rudolf Lenz, violin virtuoso; Prof. Carlo Giacomini, Gambetta, Broca, Bertillon, Assezat, Asseline, Véron, Gauss, Fuchs, Dirichlet and perhaps a few others. The brain of Prof. Giacomini, recently studied (*Giornale della R. accademia de Torino*, August, 1900, pp. 737-808), is said to add a noteworthy item to the chapter of coincidences since it exhibited an anomaly which he himself was the first to describe, namely: *two central fissures*, and therefore a *gyrus Rolandicus*, so-called, upon the right side. Upon closer scrutiny of Prof. Sperino's descriptions and plates, it has become evident to the writer that the supposed second central is an unusually long and well marked post central fissure.

Still fewer brains of eminent women have been studied. One is that of Madam Sonya Kovalewski, the celebrated mathematician, and another is that of Laura Bridgman, who, though bereft of the powers of language, sight and hearing, displayed an intelligence and education of a remarkable degree. Kovalewski's brain, after being immersed in alcohol for four years, weighed 1,108 grams; Retzius calculated the original weight to have been about 1,385 grams. (G. Retzius: *Biologische Untersuchungen, Neue Folge*, 1900, IX, pp. 1-16.) Laura Bridgman's brain weighed 1,389.5 grams after having been immersed in a two per cent. solution of potassium bichromate for about three months. Donaldson (*Amer. Jour. Psychology*, III, No. 3, 1890, p. 306,) thinks that the probable weight was somewhat over 1,200 grams.

In this view of the subject the writer ventures to assume that the presentation of the following preliminary account may not be uninteresting when it is learned that it is based on the examination of the brains of two eminent physicians, which have been "saved for scientific uses rather than wasted upon worms." But what is of especial importance and without precedent is that one is the descendant of the other, and furthermore, that their ancestors and several relatives of the same name had been for several generations physicians, chemists, engineers and architects, and that the ancestral history is marked by many meritorious achievements. The brains of which I speak are those of Dr. Edouard Seguin, and his son, Professor Edward C. Seguin, both of whom were distinguished for high scholarship and brilliant attainments.

BRIEF BIOGRAPHICAL SKETCHES.

The elder Seguin was born at Clamecy, Department of Nièvre, in France, on January 20, 1812. As I alluded to above, his ancestors for several generations were eminent as physicians, architects, etc., ranking at the head of their professions in the department. Dr. Edouard Seguin received a very thorough education at the college of Auxerre, and at that of St. Louis, in Paris. He then commenced the study of



DR. EDOUARD SEGUIN.

medicine with the celebrated Itard as preceptor, and was subsequently associated with Esquirol, the distinguished alienist and psychologist, in his investigations. The study of what is now known as arrested mental development began with Seguin's devotion of his young life and talents to the welfare of the idiot children at the Hospice de Bicêtre, and for over forty years he remained devoted to the cause he had made his

own. The works he published have been recognized as authorities to the present time. In this country he was the pioneer in advocating the introduction of the metric system, and he is equally noted for his contributions to the subject of medical thermometry. His son, Dr. Edward C. Seguin, departed this life so recently that it and his work are yet a fresh reminiscence. With the favoring ancestry already alluded to, it is not surprising that the younger Seguin should attain his



DR. EDWARD CONSTANT SEGUIN.

prominent position. Born in 1843, in Paris, and coming to the United States with his father in 1850, he received a public and high-school education in Cleveland, Ohio. In 1861 he began the study of medicine with his father and after a three years' course at the New York College of Physicians and Surgeons—showing his brilliant qualities even as a student—he graduated in 1864, being then only 21 years of age, and after

having at that early age served as a medical cadet in the regular army. Among other appointments which he received, was that of house physician at the New York Hospital. He developed a pulmonary trouble which was recovered from during a sojourn at Forts Craig and Selden, in New Mexico. From 1871 to 1885 he was lecturer at the College of Physicians and Surgeons on diseases of the nervous system and insanity. In 1873 he founded the clinic for nervous diseases in that college. He was a member of many societies in both hemispheres, and his contributions to the pathology and therapeutics of nervous disorders are especially valuable and rendered his position in the literature of the medical world a very prominent one. He will always be distinguished as one of the pioneers of American neurology. An indefatigable worker, his labors were all characterized by a methodicity which has become traditional among his friends and pupils. He died on February 19, 1898.

BRAIN OF DR. EDOUARD SEGUIN.

The elder Seguin's brain was removed within 24 hours after death by Dr. E. C. Spitzka, assisted by Dr. R. W. Amidon, on October 29, 1880. Its appearance and texture were normal, but there appeared to be a trifle less cerebrospinal fluid than usual. The brain-weight was recorded as 2 pounds, 12 ounces, 5½ drams, equivalent to 44.344 ounces or 1,257 grams. At the present time, after over 20 years' immersion in alcohol, this weight is reduced to 880 grams, the loss amounting to 377 grams, or 30 per cent. of the original weight.

The weights of the different parts of the brain* on December 3, 1900, were as follows:

Left hemicerebrum, . . .	365 grams.
Right hemicerebrum, . .	367 grams.
Cerebellum,	84 grams.
Isthmus,	64 grams.
<hr/>	
Total,	880 grams.

* The division of the cerebral segments was not made strictly in accordance with Meynert's plan, but according to a modification which utilizes the ectal border of the optic tract, and the tænia thalami (ripa) as guides for a single simple incision; those of either side converge forward to meet in front of the chiasm; the usual cut through the callosum and lamina terminalis completes a trisection which leaves the prosencephalon and brain-axis separated as nearly the ideal as can be.

According to Marshall's tables the average brain-weight for a man of the height of 65 inches or under, and between the ages of 40 and 70, is 45.74 ounces (= 1,296 grams). It must not be forgotten, however, that the brain-weights of the French are somewhat less than those of the English which Marshall's figures represent; and if we remember that Dr. Edouard Seguin was about 64 inches in height and was in poor health for some time prior to his decease, his brain-weight of 1,257 grams cannot be said to deviate much from the normal figures, and, if anything, would point to the occurrence of some wasting of the brain-tissue from disease, or age, or both. Various estimates of Dr. Seguin's body-weight range between 125 and 145 pounds, giving ratios, as compared with the brain-weight, ranging between 1 : 45 and 1 : 52. The latter ratio was also found in the case of George Grote by Marshall, and was probably due to the same or similar causes.

BRAIN WEIGHTS OF EMINENT MEN.

[This table is only provisionally arranged, as a few of the figures have not yet been verified by the writer. The authorities for these weights have been omitted here, but will be fully supplied in the final report.]

Name.	Occupation.	Age.	Brain-weight.
Ivan Turgenieff.....	Poet and novelist.....	65	2,012
G. Cuvier.....	Naturalist.....	63	1,830
E. H. Olney.....	Mechanician and author...	59	1,816
E. H. Knight.....	Mechanician.....	54	1,813
von Bismarck.....	Statesman.....	83	1,807
Abercrombie.....	Physician.....	64	1,786
B. F. Butler.....	General and lawyer.....	74	1,758
— Olney.....	College professor.....	...	1,701
W. M. Thackeray.....	Humorist.....	62	1,658
Rudolf Lenz.....	Violin-virtuoso.....	?	1,636
John Goodsir.....	Anatomist.....	53	1,629
W. von Siemens.....	Physicist.....	68	1,600
F. B. W. v. Hermann.....	Economist.....	73	1,590
J. K. Ribbeck.....	(Industr.).....	61	1,580
K. Spurzheim.....	Phrenologist.....	56	1,559
J. Y. Simpson.....	Physician.....	59	1,531
P. G. Dirichlet.....	Mathematician.....	54	1,520
C. A. De Morny.....	Statesman.....	54	1,520
D. Webster.....	Statesman.....	70	1,518
John Campbell.....	Lord Chancellor.....	82	1,517
Chauncey Wright.....	Philosopher.....	45	1,517
— Schleich.....	Writer.....	56	1,503

Name.	Occupation.	Age.	Brain-weight.
Thos. Chalmers.....	Theologian.....	67	1,502
E. C. Seguin.....	Physician.....	55	1,502
von Helmholtz.....	Physiologist.....	73	1,500
Napoleon III.....	Sovereign.....	65	1,500
K. H. Fuchs.....	Pathologist.....	52	1,499
C. Giacomini.....	Anatomist.....	...	1,495
L. Agassiz.....	Naturalist.....	66	1,495
De Morgan.....	Mathematician.....	73	1,494
K. F. Gauss.....	Mathematician.....	78	1,492
— Babbage.....	Mathematician.....	79	1,488
K. von Pfeufer.....	Physician.....	63	1,488
Paul Broca.....	Anthropologist.....	56	1,484
Louis Asseline.....	Journalist.....	49	1,468
M. D. Skobeleff.....	General.....	39	1,457
C. H. E. Bischoff.....	Physician.....	79	1,452
J. A. H. Gylden.....	Astronomer.....	...	1,452
— Lamarque.....	General.....	63	1,449
F. R. von Kobell.....	Poet and geologist.....	79	1,445
— Dupuytren.....	Surgeon.....	58	1,437
Franz Schubert.....	Composer.....	70	1,420
A. Thorndyck Rice.....	Diplomat.....	35	1,418
J. E. Oliver.....	Mathematician.....	65	1,416
Melchior Meyr.....	Poet and philosopher.....	61	1,415
George Grote.....	Historian.....	75	1,410
J. Huber.....	Philosopher.....	49	1,409
J. Assezat.....	Journalist.....	45	1,408
— Bertillon.....	Anthropologist.....	62	1,398
W. Whewell.....	Philosopher.....	72	1,389
— Coudereau.....	Physician.....	50	1,378
H. T. von Schmid.....	Writer.....	65	1,374
J. G. J. Hermann.....	Philologist.....	76	1,370
K. F. Hermann.....	Archaeologist.....	51	1,358
von Schlagintweit.....	Explorer.....	51	1,352
J. von Liebig.....	Chemist.....	70	1,352
Ludwig II.....	Sovereign (insane).....	41	1,349
J. P. Fallmerayer.....	Historian.....	71	1,349
J. H. Bennett.....	Physician.....	63	1,332
— Seizel.....	Sculptor.....	5(?)	1,312
R. E. Grant.....	Anatomist.....	80	1,290
Walt Whitman.....	Poet.....	72	1,282
Edouard Seguin.....	Physician.....	68	1,257
v. Lasaulx.....	Physician.....	57	1,250
E. Harless.....	Physiologist.....	42	1,238*
L. von Buhl.....	Physiologist.....	64	1,229
J. F. L. Hausmann.....	Mineralogist.....	77	1,226
I. von Döllinger.....	Physiologist.....	71	1,207*
F. J. Gall.....	Phrenologist.....	70	1,198
Léon Gambetta.....	Statesman.....	44	1,160*

* The weight of these brains when fresh will always remain unknown.

In the above list of brain-weights of eminent men compiled by the writer from various sources, Dr. Edouard Seg-

uin's position is rather a low one, but the idea that intellectuality always presupposes a heavy brain has long ago been demonstrated as groundless. Still, such a table has its value in showing that the maximum frequency of brain-weights of eminent men occupies a distinctly superior position as compared with those of ordinary individuals, and that the significance of brain-weight as an index of intellectual capacity must depend upon the proper collation of a sufficiently large number of cases, and the correlation of contributory and complicating factors.

Concerning the general form of the cerebrum the reader is reminded that during its immersion in alcohol for a score of years there has naturally been considerable shrinkage and flattening. Giving due allowance to this unavoidable distortion, its striking features can be enumerated as follows:

Marked development, with great breadth and fulness of the frontal lobes.

A great width and ample development of the parietal and temporal lobes.

Relatives smallness of the cuneus in both halves, especially the left.

General tortuosity of the fissures and gyres.

A full and ample development of the left insula, especially of its cephalic (anterior) portion, the insular pole being very fully developed, and far better than on the right side. A portion of the left preinsula is visible.

The sylvian cleft is more horizontally directed than in most brains. This approach to the horizontal is more marked on the left side, and is generally considered an important indication of superior development.

The left parietal and paroccipital fissures are separated while on the right side they are confluent. This arrangement is quite rare, having been found in 6 per cent. of cases by Wilder¹ and the writer.²

The fissures on the whole are characterized by their generally tortuous paths, by their great depth, and perhaps by a greater frequency in their deep interruptions by vadums and interdigitating subgyres. In general the gyres are neither of maximum nor minimum width; their size seeming to be determined by a tendency to crowd the greatest number—more or less regularly and evenly—into the available space. They are bold and massive, so that in spite of the intricate fissura-

tion the configurations of the brain are neither "overcrowded" nor "cramped-looking." There is that in the "physiognomy" of the brain as in the son's, which it is impossible to describe, otherwise than in terms the very use of which would suggest the having preconceived notions of a relation between structure and function, to say that it portrays the culture, refinement and intellectual capacity of its erstwhile owner when living.

The indices of the lobes* of the left hemicerebrum are :

Frontal index,	60.4
Parietal index,	22.2
Occipital index,	17.4

On the right hemicerebrum :

Frontal index,	58
Parietal index,	20.6
Occipital index,	21.4

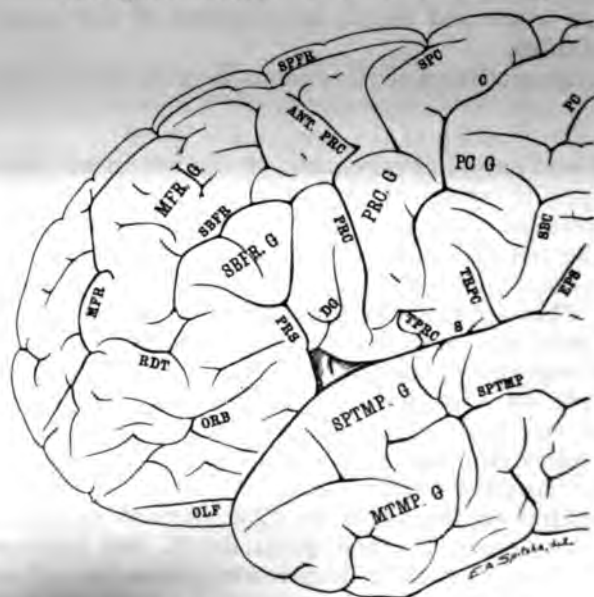


Fig. 1. Frontal portion of the left hemicerebrum of Edouard Seguin (father) showing exposed area of the preinsula, and also the well-developed opercula.

*The indices were measured along the dorsomesal border of the hemicerebrum, from the frontal pole, and are expressed in terms regarding the entire hemisphere as equivalent to 100.

These figures indicate in a measure the better development of the left frontal and parietal lobes.

The frontal gyres are the most complex of the entire brain, being particularly rich in their windings, though the parietal gyres are almost as rich in their development. The sub-frontal gyrus (Broca's convolution) of the left half is very well developed, as might be expected, in a right-handed individual with a left speech center. (See Fig. 1.)

Upon the left half the "intraparietal fissural complex" is remarkable in that all four of the so-called segments are distinctly separated from each other, a condition rarely observed and found by Cunningham³ in only four hemispheres out of sixty-two; once on the left, once on the right, and once on both halves. Mickle⁴ regards such bridging of the so-called

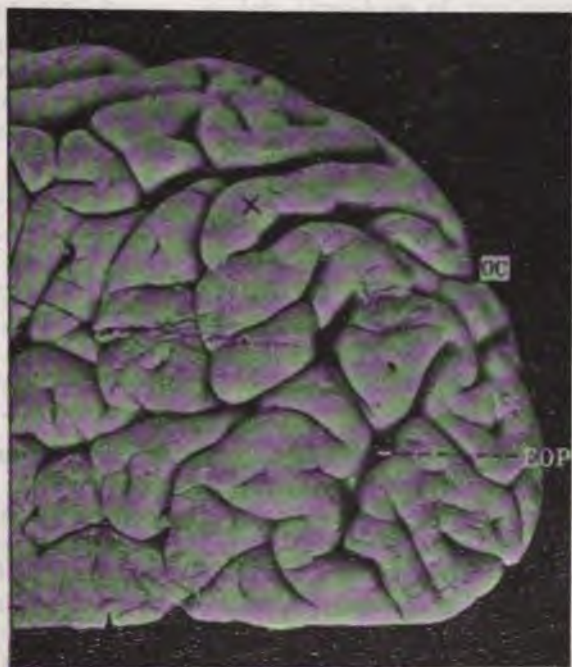


Fig. 2. Occipital portion of left hemisphere of Edouard Seguin (father) showing the remarkably distinct exoccipital fissure (EOP) as well as the paroccipital isthmus, marked by the cross (X). OC marks the occipital fissure. (Photograph by Dr. E. Leaming.)

"intraparietal sulcus" as a mark of superiority in brain evolution. The paroccipital fissure, which is of the true zygial type, is absolutely separated from the parietal fissure by a well-developed "paroccipital isthmus." (See Figs. 2 and 3.) Upon the right half there is a confluence of the corresponding fissures. This brain, therefore, presents an additional example of a rare arrangement hitherto unnoticed in the brains of moral and educated persons, at least so far as the writer knows. Of the six cases recorded by Wilder¹ there were three of unknown history, while the remaining three whose history was known, were insane, one a Swiss woman, one an engineer, and one a negro. The writer² has since found a similar arrangement in six of the one hundred brains of dissecting-room subjects, derived mainly from the pauper class dying in the municipal hospitals and charitable institutions.

As stated above, the occipital index on the left half is as 17.4 : 100, and on the right half as 21.4 : 100, according to Cunningham's method. This index averages 20.8 for human adult males, and 21.7 for females; and it increases as we descend to the anthropoids and apes. The following are Cunningham's figures :

Orang,	23.2
Chimpanzee,	24.2
Hamadryas,	29.5
Cynocephalus,	29.7
Mangaby,	30.5
Macaque,	31.
Cercopithecus,	32.9
Cebus,	33.1

It was recognized as being of considerable importance by even so early an observer as Gratiolet, and it would seem to indicate, other things being equal, that relative smallness of the cuneus, measured in this manner, signified superiority. Its exemplification upon the better developed left half of both of the Seguius' brains would seem to lend force to this hypothesis.

Notable for its extent and well-marked course is the exoccipital fissure on the left side. (Fig. 2.) It begins very near the zygion of the paroccipital, at its caudal part and separated from it by a narrow (3 millimeters) "deuxième pli de passage." Morphologically speaking, therefore, the fissure

falls into the first class of Wernicke's descriptions,⁵ a condition occurring normally in some apes. As the fissure passes ventrad a notable fact is the nature of the slope of its walls, which, as in the right half, incline distinctly caudomesad. It resembles a cleft rather than an ordinary fissure, and in its depths can be seen several interdigitating subgyres. As the fissure approaches the ventro-lateral border it takes an abrupt caudal direction and terminates just at the border. Around this end curves a narrow "quatrième pli de passage." The "troisième pli" may be any one of the several interdigitating subgyres alluded to above.

Upon the right half the "troisième pli" instead of being totally submerged, approaches to within seven millimeters of the surface and is capped by the lip of the poma (occipital operculum), so that it may properly be termed a subgyre. The exoccipital fissure consists, therefore, of two segments, a

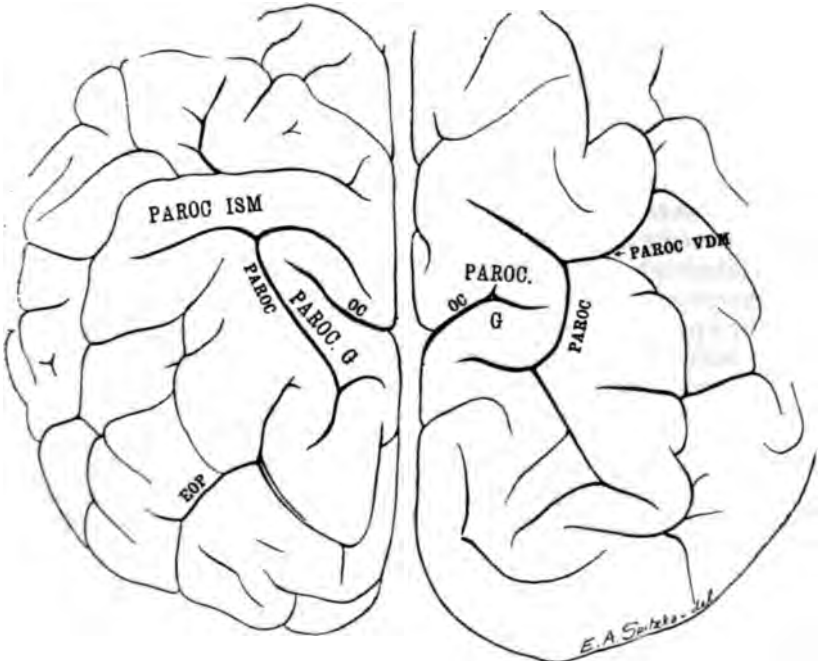


Fig. 3. View of the occipital regions of both hemispheres of Dr. Edouard Seguin (father). On the left a distinct paroccipital isthmus (PAROC. ISM.) separates the parietal from the paroccipital; on the right these fissures are confluent over a vadam at a depth of 11 millimeters.

superior (EOP') and an inferior (EOP''), superficially confluent with each other.

In both hemispheres the occipital lobe exhibits a distinct tendency to overlap the parietal gyres; the walls of the exoccipital fissure slope distinctly mesocaudad, suggesting the pomatic homology and derivation of the occipital lobe.

The insula on the left side is far better developed than its fellow on the right half, corroborating the statement made by Waldschmidt,⁶ that in educated men the left insula is "incomparably richer" in its development than the right. Upon close inspection, and by means of soundings made in the sylvian cleft, this redundancy is found to be most marked in the preinsular region.

BRAIN OF DR. EDWARD C. SEGUIN.

The autopsy upon the younger Seguin took place on February 21, 1898, and was made by Dr. J. S. Thacher, assisted by Drs. J. Arthur Booth and E. C. Spitzka. Drs. Hallock and Pooley were present. The brain was removed about 30 hours after death, also by Dr. E. C. Spitzka, my father, and to him I am indebted for the opportunity of studying and describing both of these valuable brains, unprecedented in so far as I can find no other instance where the brains of father and son were available (both being of marked characteristics), and the nearest approach being the case of the brothers Leidy, of Philadelphia, undescribed as yet—and at present in the collection of the Anthropometric Society of that city.

The appearance and texture of the younger Seguin's brain were normal. After dissection and draining the total weight was 1,502 grams, or 52.98 ounces. The parts of the brain while still fresh weighed as follows:

Right hemisphere,	.	.	642 grams.
Left hemisphere,	.	.	653 grams.
Cerebellum,	.	.	140 grams.
Isthmus,	.	.	67 grams.
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Total,	.	.	1,502 grams.

The brain was again weighed on December 3, 1900, after nearly three years' immersion in formaldehyde solution:

Right hemicerebrum,	555 grams.
Left hemicerebrum,	563 grams.
Cerebellum,	109 grams.
Isthmus,	57 grams.
<hr/>	
Total,	1,284 grams.

The loss in weight amounted to 218 grams, or 13 per cent. of the original weight.

This brain-weight (53 ounces in round numbers) is about 4 ounces, or about 125 grams above the average for one of Dr. E. C. Seguin's age and height, and his position in the list of brain-weights of eminent men is comparatively high.

Owing to the excellent preservative qualities of formaldehyde, this brain is only slightly flattened, and the shrinkage amounts to very little. As in the father's brain, there is a slight but unquestionable exposure of the left preinsula. The left sylvian fissure more nearly approaches the horizontal, and there is a similar ample development of the frontal lobes characteristic of the father's brain. The indices of the lobes are :

Left hemicerebrum :

Frontal index,	61
Parietal index,	23.6
Occipital index,	15.3

Right hemicerebrum :

Frontal index,	57.2
Parietal index,	26.3
Occipital index,	16.3

The relatively small index of the occipital lobe is particularly noteworthy in both halves of this brain.

The left separation and right continuity of the parietol-paroccipital fissures spoken of in the father's brain are in the son's brain reversed as to sides. On the right side a well-marked isthmus separates the fissures, on the left they are confluent over a vadium.

On the right half the exoccipital fissural complex does not differ very much in its appearances from the left half of the father's brain, except that the "troisième pli" is flush with the cerebral surface and not submerged.

The left insula, as in the father's, is far better developed

than the right, and the preinsular portion is so redundant that the surrounding opercular parts have been crowded apart and a small triangular portion of the insular pole is thus made visible upon the lateral aspect.

If one be permitted to indulge in such an expression I would say that the *physiognomy* of each of these brains reproduces that of the other, much as the outer physiognomy of their bearers did in life. By the metaphoric term "physiognomy" used in this connection, I mean the general feature of the arrangement, relations and molding of the convolutions, difficult to describe in so many words and renderable only through photographic or other reproduction, and even through these imperfectly. Every brain I have yet examined had its distinct features, as much distinct as the outer ones of its owner. One may distinguish brains resembling each other as a group, and as distinguishable from other groups as are different families and races of men. No more striking instance of a prevailing typical difference can be adduced than that of the Mongolian brains recently studied by Dercum and others. It were futile to attempt basing a discrimination on any single factor. It is the general physiognomy that seems to be so peculiar to the race, but by this I do not mean that given a certain brain an investigator could declare it to belong to such and such a race or sex. We are not advanced far enough for that yet, if we ever attain such a point; and how mistaken we may be in regard to the outer features I need not remind the reader. We are much like the traveler who merely touching the shores of a new land is struck by the, to him, strangely and strikingly uniform character of a new race—yet whose individuals are as distinguishable to their fellow tribesmen as that traveler's companions are to him.

Perhaps the most significant feature common to both brains is the exposure of the insula, and although this feature formed the theme of a special paper⁷ a brief summary thereof may not be out of place here.

Heretofore it was only in the brains of deaf-mutes, of negroes, of idiots, and of the defective classes generally, where the opercula are commonly atrophied, that the insula has been found visible. It was therefore regarded as an indication of inferior development. The brains of the Seguins, however, present the very reverse of low form or defective type. Nor are the insular regions at all defective, though they fail

to come into typical apposition. The explanation of this anomaly is that the left preinsula is far better developed than its fellow on the right side, corroborating the findings of Waldschmidt (in 1887) upon the brains of two professors of the University of Freiburg. But in the Seguin brains this redundancy of development upon the left side is so pronounced, that the insula in a *quasi*-struggle to reach the general cerebral surface, has virtually thrust apart the opercula and made itself visible.

The interpretation of this exposure as due to the relative hypertrophy of the insula is sustained by the results of "soundings" taken at various points, and given in millimeters in the following table.

The terms pre-, medi-, and post-insular depth refer to the three points at which the Sylvian cleft was sounded, the pre-insular point being the junction of the Sylvian with its pre-sylvian ramus, the medi-insular point being at the middle of the course of the Sylvian, the post-insular being at the junction of the Sylvian cleft with its episylvian ramus.

DEPTHS OF THE SYLVIAN FISSURE IN THE FOUR HEMI-CEREBRUMS OF THE TWO SEGUINS.

EDOUARD SEGUIN (Father).

	Left.	Right.
Pre-insular depth,	11 mm.	18 mm.
Medi-insular "	22 "	22 "
Post-insular "	24 "	22 "

EDWARD C. SEGUIN (Son).

	Left.	Right.
Pre-insular depth,	7 mm.	15 mm.
Medi-insular "	20 "	23 "
Post-insular "	25 "	25 "

The conclusions naturally to be drawn from the above are that the causes potential in insular exposure must be discriminated or classified as follows:

Class 1.—In the highly intellectual (for example, the two Seguins), owing to the excessive growth and development of the left pre-insula, causing a displacement of the opercula, thrusting them apart, as it were, and even though the latter be very well developed.

Class 2.—In the defective, exposure of the pre-insula is due to deficient development of the opercula and because these fail to approach each other. In such cases the insula it-

self is, without a single exception in the series that I have studied, of inferior development, indicated not only by the soundings of the Sylvian cleft, but also by the flatness of configuration and lesser area of the insular cortex.

In the paper referred to, the writer said: "Among the reflections which occur in the course of such a study, is the possibility of some paternal influence exerted on the brain of the offspring under circumstances such as the following: Dr. Edouard Seguin (the father) was most actively engaged in the teaching of the idiot children at the Hospice de Bicêtre, wrote many treatises, and delivered many lectures upon the subject in the six years prior to the younger Seguin's birth. If physiological tendencies are transmitted from father to son, and if such transmission of function finds structural expression, one would expect it to be demonstrated where the circumstances are so favorable as here. Of course, all such statements are made tentatively; yet what would be a more natural conception when we view the circumstances, the visible evidences in the two brains, and the corroborative soundings of the Sylvian fissure of both sides. Both men were of high intellectual capacity; both were facile writers and speakers—if anything the son excelled the father; and both were polylinguists, speaking and writing three languages fluently. The teaching capacities of both men were remarkable, in the one case being especially devoted to the patient efforts required in the training of the feeble-minded, in the other developed in the highest degree in didactic lecturing and clinical teaching."

This unexpected exposure of the insula has been noted on both sides in the brain of Chauncey Wright, now in the care of Prof. Burt G. Wilder. In his Handbook article,⁸ written in 1889, Wilder called attention to the fact that possibly pressure may have caused sufficient displacement to artificially expose the insula. In a letter to me (March 12, 1901,) in response to a communication in which I suggested the explanation here advanced, Dr. Wilder states that probably the exposure of Wright's insula was also natural. This investigator proposes to review the matter as soon as he returns to Ithaca.

There are a number of facts which, naturally grouping themselves together, justify as a strong surmise, if not a scientific probability, this anticipation: that hereditarily transmitted and identifiable individualities in gyral disposition will be first and most definitely determined in the region of the insula. To sustain this proposition by the experience of the

single case here presented were absurd; it simply points in the direction of the following logical chain—partly of obtained facts, partly of natural conclusions from these.

In a study made of heredity, whose results were placed at my disposal, covering the parentage and descent of individuals prominent in various fields of science, politics, art and handicraft, it is found that the cases where both father and son attained distinction sufficiently to merit place (in the biographical encyclopedias), in intellectual fields of labor, they had been of those in whom skilled motor innervations in their association with sensory impressions and registrations are prerequisites. Preeminently is this the case with two professions—that of the composer-musician and that of the philologist. As defects in speech are so likely to be repeated in a family line, it seems that its skilled employment by the ancestor is similarly reflected in the way of facile acquirability on the part of the descendant. Not unrelated may be the fact that among those recruited for the ranks of linguists of other than philologist parentage, there largely predominate those whose parents had emigrated or who were born on islands, in seaport towns or in lands where two dialects are spoken, not to mention those in whose families it has been the custom to maintain an ancient tongue for sacerdotal reasons.

The speech faculty in its intimate relations to thought-expression, to memory—in its reading-form to sight, in writing to manual muscular innervation, exquisitely hereditary as it is in life, and most accurately localizable in the ravages of disease, as shown after death, appears one whose transmission is most likely to be expressed by morphological signs—be they relative and quantitative or purely morphological—and these in and about the Island of Reil.

I have said that there exists a resemblance between the "physiognomies"—if I may use that term—of these brains. But if the various features of these specimens be separately analyzed and compared this resemblance becomes a striking one. The view that a coincidence of features in the brains of parent and child is due to an actual *transmission*, as that term is now understood, gains in plausibility in proportion as such features are marked or exceptional, and most so, as in the brains before us, where they approach the atypical.

The term *atypical* as here used is so in a morphological sense only, and not as equivalent to the sense of aberrant

atyp—heterotyp—found in grossly asymmetrical and pathological brains. Just as it is the simplest brains that are more symmetrical than the higher one, so the simplest arrangement of gyres is also the one which is most purely and symmetrically typical. With higher development, a certain degree of deviation from the type seems an inseparable accompaniment of the luxuriant development, contorted foldings, and deep as well as complicated fissuration, which represent a struggle for surface and expansion, in which the interests of neighboring formations often balance unevenly. This irregularity is regular even in its irregularity, however, of the surface only, and in this respect parallel to those perhaps not unrelated manifestations of the living organ of the mind, which in the shape of originality or ingenuity are often misapprehended and interpreted as evidence of unbalancing and eccentricity. It is because the simple mind has not breadth enough that it neither indulges in excursions into a field of original thought, nor understands such when indulged in by others. So it is because there is little rivalry of growth interests in an unexpansive organ that its simple gyres repose in the rough and comprehensible simplicity of the Bechuana folds.

"To certain minds fate narrow bounds has set,
In vain they try beyond those bounds to get."

In reality all these qualities are but expressions of a strong individuality; and individuality is not conceivable otherwise than as an expansion beyond the average mediocrity,—expansion in the direction of deviation from that of the common rut.

In the case of the two Seguin brains it is safe to say that if they had been scattered among a hundred other brains, and these had been grouped according to the type of gyral disposition, they would have come together as the classification became finer and finer until ultimately they probably would have constituted a group by themselves.

The asymmetry of the halves of highly-developed brains must therefore form the basis for demonstrating hereditary transmission in the brains of parent and child before us; and it is for such unilateral features that we must search. They are present in sufficient number to establish the proposition, and while I am prepared to enumerate these at length, their presentation and discussion would require more space than it is my privilege to occupy. Briefly stated, the most important of these features common to both brains are:

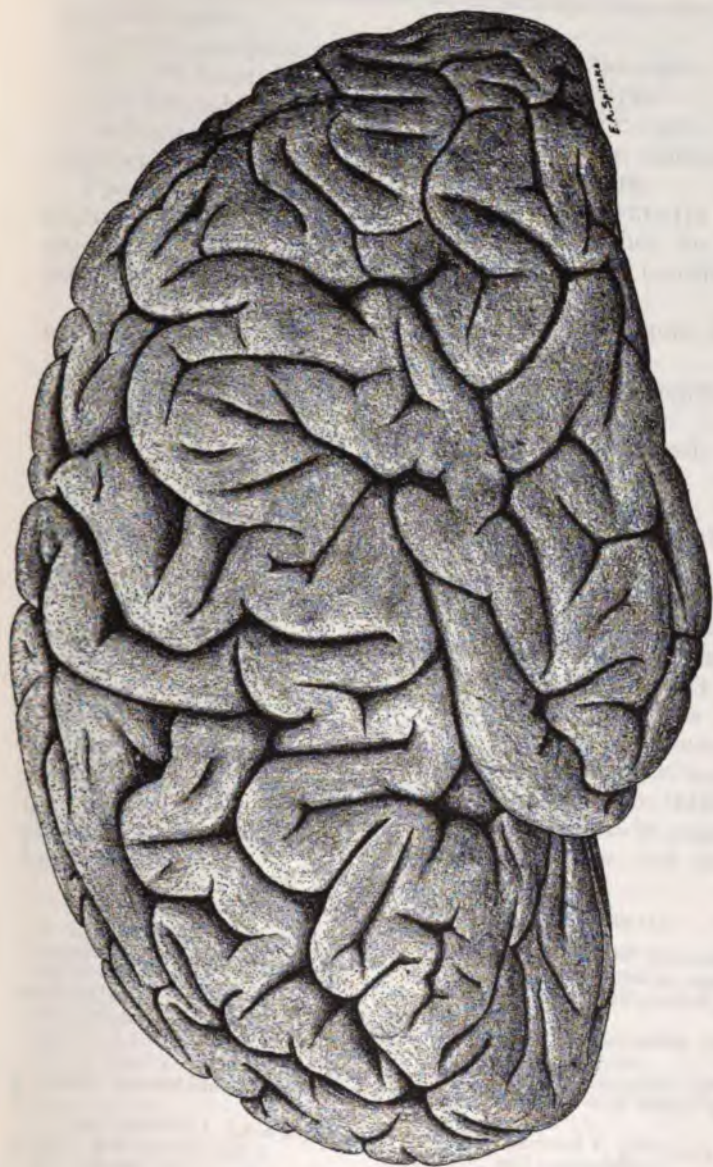


Fig. 4. Lateral view of the left hemicerebrum of Dr. Edward C. Seguin (son). Aside from the redundant development of the operculum, and the nearly horizontal course of the Sylvian fissure, the most striking feature is the visibility of the preinsula, whose summit approaches within 7 mm. of the cerebral surface. $\times .83$ natural size. From a drawing by the author.

The left insula exhibits an incomparably richer development than the right.

The left occipital index is smaller than the right.

The left frontal index is larger than the right.

The left subfrontal gyrus is larger than the right.

On both right operculums there is a single isolated fissure embraced by the limbs of the presylvian fissure.

The left medifrontal fissure is in two segments (in one case separated by a superficial isthmus, in the other by a slight vadium of 4 millimeters). Furthermore, the medifrontal is poorly represented on the right sides.

The left cephalic limb of the paracentral fissure is short; long on the right.

The left episylvian fissure, and also the hyposylvian are longer than on the right half.

The left fronto-marginal fissural segments are easily traced; they are absent on the right sides.

The left olfactory fissure is shorter than the right.

The left Sylvian fissure more nearly approaches the horizontal than does the right.

The existence of these and other facts give strong evidence of *direct hereditary transmission*. In addition, however, there are other interesting points of resemblance in attributing which to such transmission, one strange apparent difficulty is encountered, namely: their reversed position as to sides. This "crossed heredity," or the reproduction of unilateral asymmetrical peculiarities of one side in the father's brain upon the opposite side in the son's, would constitute an interesting chapter in itself. An enumeration of the facts in support of this mode of *crossed hereditary transmission* can only be briefly made here.

FATHER'S BRAIN.

I. Left parietal f. and paroccipital f. separated; continuous on right.

II. Postcalcarine f. bifurcated on right only.

III. Right occipitocalcarine angle = 70° ; left 60° (circa).

IV. Father's right "exoccipital complex" almost identical with son's left.

V. Left parietal f. joins supertemporal f. and intermedial f.

VI. Mode of junction of right medifrontal f. with orbitofrontal f. exactly as in son's left.

VII. Father's right half heavier.

SON'S BRAIN.

Left parietal f. and paroccipital f. continuous; separated on right.

Postcalcarine f. bifurcated on left only.

Right occipitocalcarine angle = 60° ; left = 70° (circa).

Son's left "exoccipital complex" almost identical with father's right.

Right parietal f. joins supertemporal f. and intermedial f.

Mode of junction of left medifrontal f. with orbitofrontal f. exactly as in father's right.

Son's left half heavier.

The last item is one to which I am not prepared to attach too much importance, for observations upon the weight of the halves of a dissected brain come within the range of error usually ascribed to the "personal equation."

The history of inheritable peculiarities, such as sex, polydactylism, abnormalities of the external ear, and the like, shows that the problematical mechanism of their transmission acts without regard to any other plan, in this respect, than that of "symmetry in asymmetry;" namely, it impresses the same or similar variation from the typical, if not on both sides, on either side alone, and indifferently as to correspondence with the one parentally involved.

Any declaratory explanation for the contralateral situation of the same or similar atyp in the brains of parent and child must rest on conjecture. The influences at work in molding organic forms are profoundly mysterious; particularly is this the case where symmetrical relations are in question. I need but refer to the possible relations of this fact to the more familiar ones just referred to, such as one-sided peculiarities of the pinna, the digits, or the orbits; and that these influences act contralaterally as well as unilaterally, and as harmoniously in their inversion as in those rare cases of complete transposition of the viscera. Let me instance an authentic case of maternal impression reported by Dr. W. L. Swift (*New York Medical Journal*, October 9, 1886, p. 407), where the birthmark not only repeated the original one-sided maternal impression, but was also duplicated, both sides of the body showing it. * * * Brown-Sequard demonstrated the hereditary transmissions of lesions in the nervous system of guinea-pigs, the change in the descendants often being bilateral where they had been unilateral in the animals experimented upon. (*Comptes rendus*, Vol. xciv, 627.) The deformities of "hammer-toe" and "syndactylism" may likewise exhibit unilateral, bilateral or even contralateral transmission. Lastly, I would allude to the mirror-like reproductions of physiological and pathological phenomena on opposite sides in certain forms of hysteria.

If such modes of transmission be wonderful and mysterious how much more so is that of the hereditary influences of which we speak. When we remember that we are dealing here with the one organ of the body that is so variable that no two individuals possess it exactly alike, so far as exter-



nal appearances are concerned, the importance of determining as nearly as possible the influences of heredity will be understood readily enough. More material of this kind, and extended observations upon this line are necessary before we can arrive at any satisfactory conception of the external appearances of this most important organ. Anatomists and scientists in general cannot urge too strongly upon their fellow-men and women the importance of bequeathing their brains to the uses of a science which might well regard such bequests, if not as invaluable as the legated brains once had been to their original owners, of the very highest one, such being indispensable to progress in psychological physiology.

For valuable aid and information cheerfully given while pursuing this study, the writer wishes to express his sincere thanks to Mrs. E. M. Seguin, and to Drs. J. Arthur Booth, E. Leaning, and Professor B. G. Wilder.

ABBREVIATIONS.

Fissures.

ANT. PRC.,	.	.	.	.	.	"Anterior precentral."
C.,	.	.	.	.	.	Central.
DG.,	.	.	.	.	.	Diagonal.
EOP.,	.	.	.	.	.	Exoccipital.
EPS.,	.	.	.	.	.	Episylvian.
MFR.,	.	.	.	.	.	Medifrontal.
OC.,	.	.	.	.	.	Occipital.
OLF.,	.	.	.	.	.	Olfactory.
PAROC.,	.	.	.	.	.	Paroccipital.
PAROC. VDM.,	.	.	.	.	.	Paroccipital vadum.
PRC.,	.	.	.	.	.	Precentral.
PRS.,	.	.	.	.	.	Presylvian.
RDT.,	.	.	.	.	.	Radiate.
S.,	.	.	.	.	.	Sylvian.
SBFR.,	.	.	.	.	.	Subfrontal.
SPC.,	.	.	.	.	.	Supercentral.
SPFR.,	.	.	.	.	.	Superfrontal.
SPTMP.,	.	.	.	.	.	Supertemporal.
TPRC.,	.	.	.	.	.	Transprecentral.
TRPC.,	.	.	.	.	.	Transpostcentral.

Gyres.

MFR. G.,	.	.	.	.	.	Medifrontal g.
MTMP. G.,	.	.	.	.	.	Meditemporal g.

PAROC. G., .	.	.	.	.	Paroccipital g.
PAROC. ISM.,	.	.	.	.	Paroccipital isthmus.
PC. G., .	.	.	.	.	Postcentral g.
PRC. G.,	Precentral g.
SBFR. G.,	Subfrontal g.
SPFR. G.,	Superfrontal g.
SPTMP. G.,	Supertemporal g.

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PRELIMINARY REPORT ON A CASE OF CYCLOPIA.

BY DR. CHURCHILL CARMALT, NEW YORK CITY.

The Society of the Lying-In Hospital, of New York City, present through me, their representative, the following subject and its history, case number 20,484, in their records. No similar monster in records of 20,484 cases. Deformed foetus born at 36-7 weeks.

Father's history.—Russian Jew, 35 years old, tailor, small, rugged, very intelligent, ears prominent, and helix pointed. His father alive at 85; mother died in 70th year; no abnormality in either. Three brothers, two sisters and their six children have presented no abnormalities. He denies venereal disease and presents no evidence of syphilis or tuberculosis.

Mother's history.—Russian Jewess, 30 years old, large, stout woman with no marks of degeneracy or ill health. Mother and father over 70; both alive and normal. Three sisters and four brothers with seven children have had no abnormalities among them. She herself has borne 5 children in 10 years, one miscarriage at 8th month (4th pregnancy). One child died of measles, others alive and normal.

History of pregnancy.—Last child nursed while pregnant with foetus herewith presented. During, as nearly as the mother can remember, the second or early part of third month of this pregnancy, the mother, in a street brawl, was struck upon the abdomen. She "fainted away," in her own words, and was sick in bed a fortnight with small amount of vaginal hemorrhage; no medical attendance. Injured again in last two weeks of pregnancy. No evidence of syphilis or tuberculosis; no "maternal impression." She does not connect deformity of foetus with the injury.

History of delivery.—Normal; vertex; L. O. A.; duration, 10 hours and 8 minutes; second stage lasted 1 hour. Placenta, normal; weight, 512 grm.; measurements, 18 cm. by 15 cm. by 2 cm. Blood vessels, normal; cord, 51 cm. long and normal. Membranes, normal, smooth, complete. Liquor amnii, moderate in amount. Primary respiration of child delayed;

artificial respiration was done and child dipped in hot and cold water alternately; breathing took place through the mouth. Heart sounds normal, beat regular. It lived 4 hours.

Appearance of child during life.—Weight, 2 kgm. 560 gm.; total length, 48 cm.; vertex coccygeal, 31 cm. Circumference of head: occipito mental, 33 cm.; occipito frontal, 29 cm. Diameters of head: occipito mental, 13 cm.; occipito-frontal, 9 cm.; bizygomatic, 8 cm.; bitemporal, 65 mm.; frontomental, 77 mm. Anus, perforate; meconium voided; urine voided. Sacral indentation, 1 cm. deep; testes undescended. Six fingers on both hands, origin from upper phalanx, little finger. Six toes on left foot, origin from upper phalanx, little toe.

General description of head and face.—Occipital, temporal, parietal and mental regions apparently normal; ears and jaw well developed. Frontal region normal with exception of mesial aspect or junction of superciliary ridges. From that point projects a tubercle with much the appearance of a penis, 5 cm. long by 15 mm. in diameter, the base slightly constricted. On the indented apex was a minute opening less than $\frac{1}{2}$ mm. in diameter from which exuded a watery fluid, drop by drop somewhat accelerated on pressure. This fluid contained some flat epithelial cells and fatty material much broken when examined. From the base of this tubercle on either side extended outward the eyebrows, normal in appearance, and well developed. Beneath this tubercle in the median line was a reddish mass looking like granulation tissue 2 cm. broad by 15 mm. longitudinally. It was enclosed on either side by eyelids with well developed eyelashes save on median junction of the upper and lower lids, which here seemed deficient. On separation of these lids at the outer canthi normally formed, appeared conjunctiva with sclera as far inward as the red median mass. The whole cleft was 4 cm. in width. Beneath the continuous single lower lid appeared a smooth skin surface to the vermilion border of the upper lip, which appeared normal, as did the mouth, dental ridges, hard and soft palates and uvula. A probe met an obstruction in the pharynx 2 cm. above the uvula, measured post-mortem.

After death the body was kept at normal room temperature in tenement house for six hours before it could be obtained, was then put in 4 per cent. solution of formaldehyde in water, 24 hours later was injected through umbilical vein with 1 per



cent. formaldehyde in water. Injection was not very successful, and entire body was then put in alcohol and formaldehyde, the strength of which I do not know. I then obtained the body, decapitated it and froze the head for a median section to mount. Head divided with saw $\frac{1}{2}$ mm. in width, 1 mm. approximately to left of median line.

Body then was examined. There was no sternalis muscle, as has been so frequently found by Dr. Shepard in anencephalic monsters, but from the axillary borders of both pectoral groups, a single muscular sheet extended backward enveloping the outer wall of the axilla to the axillary border of the latissimus dorsi, with fibrous arch from insertion of pectoralis major to insertion of latissimus dorsi. Through the arch passed the axillary vessels. The attachment was caudad to 5th, 6th and 7th ribs and fascia over intercostals. The nerve supply was from the external anterior thoracic, as has been pointed out by Dr. Shepard on this anomaly.

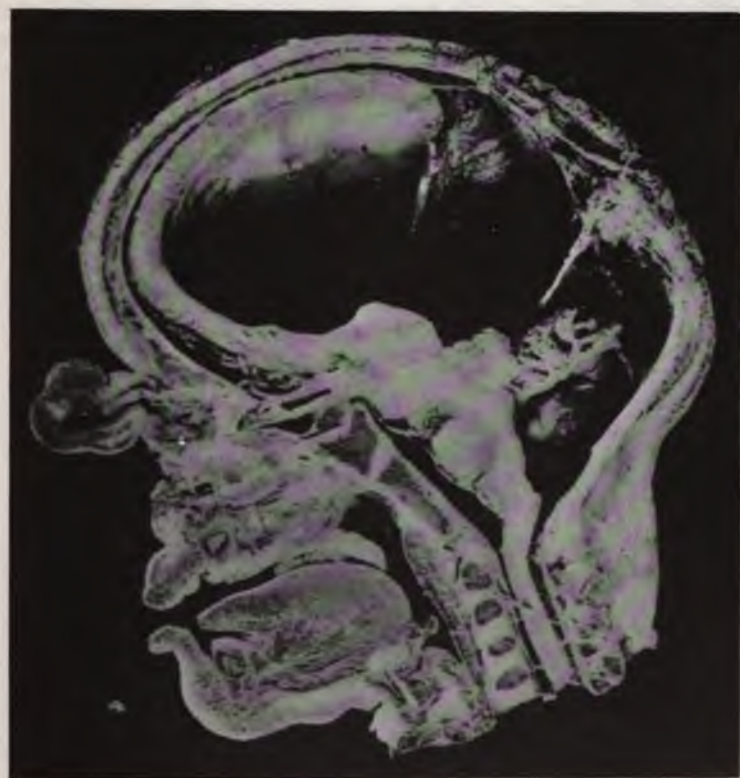
On removal of the sternum and costal cartilages, the thymus presented approximately normal as were the lungs, heart and great vessels. Lungs somewhat atelectatic. The thyroid body seemed somewhat large, 6 cm. by 5 cm. by 4 cm.; the lateral lobes embraced the trachea and oesophagus, impinging upon the vertebral column dorsally. Over right lobe of liver, beneath peritoneum of supero-external surface, was a large sub-peritoneal hemorrhage. Liver otherwise normal. Stomach normal save for attachment of omentum to transverse colon, which attachment had not taken place on left side for approximately 8 cm. Duodenum enclosed by peritoneum save for 4 cm., beneath attachment of mesocolon. Small intestines otherwise normal with exception of attachment of ileum to caecum shown in photograph, ileum passing behind caecum. Ascending and descending colon both have long mesenteric attachment, caecum is unrotated and appendix is on outer aspect of caecum, vessels and folds otherwise normal. Kidneys and adrenals normal, no hemorrhages within them; pancreas also normal. Right testis compressed by neighboring viscera into small triangular mass beneath right kidney, left testis just at outer ring, and not in scrotum. Ureters and bladder not dissected, but seem normal.

No extra muscles apparent to accessory fingers or toes.

Medial section of skull and brain shown in photographs and diagram drawn by Mr. E. A. Spitzka from the dissected

hemi-section. The latter is presented through his kindness. The skin, scalp and occipito frontalis are normal, as are the portions of parietal and occipital bones then apparent. There is no horizontal plate to frontal bone. The body of the ethmoid is represented by a small cartilaginous plate, through intervals in which pass two, possibly more, attenuated olfactory fibers. The basio-sphenoid is normal, but the sella turcica seems deficient anteriorly. Nasal bones are cartilaginous and misshapen, extending forward into protuberance, extending in front of lower end of frontal bone. Scattered bits of cartilage beneath the lower lid, irregularly separated by embryonal and irregularly-placed muscle fiber, seem to represent the unformed vomer, median plate of the ethmoid, the turbinate and palate bones. Tooth cavity normal in superior and inferior dental process. Spinal cord is normal in gross appearance. Inferior medullary velum is a thin veil between the peduncles of the flocculus. The nodulus is absent, or represented by the velum only. The metapore is a wide, open space uncovering the 4th ventricle. The small size of the cerebellar peduncles makes the floor of the 4th ventricle considerably larger than normal. The obex is ill defined.

In the floor of the 4th ventricle can be seen a well defined median sulcus, continuous with a dilated *iter e tertio ad quartam ventriculam* above and in front of it. The funiculi gracilis and cuneati are well developed and apparently normal. The cuneate tubercle of Schwalbe is enlarged as in all young human brains. The restiform bodies are poorly developed. The striae acusticae and eminentia teretes are very prominent. In consequence the superior and inferior foveae are very deep. The ligula is thick and well developed. The pons varolii of the mesencephalon is normal in gross appearance, but somewhat small. The iter is dilated evenly throughout its length (15 mm. in diameter), entering the third ventricle in relatively its normal position. The corpora quadrigemina, 20 mm. long, seem larger than normal and not differentiated in gross appearance into separate surface markings. Above the corpora quadrigemina is a flattened epiphysis, 10 mm. long by 1 mm. deep, over twice its normal size. A stalk passes cephalad from the epiphysis 1 mm., then ventrad and dorsad to posterior commissure dorsad to entrance of iter to 4th ventricle.



The cerebellum or epencephalon had a large hemorrhage over caudal and dorsal surfaces. The pia was much congested and the blood vessels seemed thickened. The lingula and superior medullary velum were normal. The lobulus centralis was small but normal in shape; its folia seemed normal. The sulcus post-centralis was well defined. The culmen monticula and its folia were also normal. The clivus was degenerate in form; its folia were diminutive. The sulcus preclivalis was well defined. The folium cacuminis was



represented by a thin layer of gray matter resting upon a thin stratum of white matter. This layer has become displaced in the specimen here presented. The horizontal sulcus was absent as were tuber valvulae pyramis, uvula and nodulus. Through the open space left by their absence are visible the flocculus, amygdala, lobi biventralis, lunatus anterior and posterior, gracilis, postero-inferior and postero-superior.

The 3d ventricle, of which the walls seemed in contact, the cavity not dilated, was 3 cm. long by 15 mm. deep. The thalami were united cephalad by an apparently enlarged middle commissure, which closed in cephalad and dorsad the anterior wall of this ventricle. Beneath this commissure and extending cephalad to it was a hollow stalk 2 cm. long, 1 cm. in diameter. This was the single or fused optic vesicles. At its mesial cephalal termination it divided into two hollow prolongations. Three mm. ventrad and caudad to the opening of the optic vesicle was the prolongation making the infundibulum, extending ventrad into an apparently normal hypophysis. A thin layer of gray matter passes caudad from the infundibulum to the floor of the iter. There is no fornix, no mammillary body, no superior pineal peduncles, no anterior commissure, no foramina of Monro. The choroid plexus did not penetrate the 3d ventricle beyond the hypophysis. The velum interpositum enfolded the hypophysis and the choroid plexus extended laterad into the surrounding fluid. Between the middle and posterior commissure is a wide opening into the space dorsad.

The optic thalami of the thalamencephalon were 2 cm. long by 15 mm. deep and (later measurement) 15 cm. wide, rounded and somewhat larger than normal.

Dorsad and cephalad to this brain, so far only moderately abnormal, is a single cyst, occupying the rest of a normally-shaped cerebral cavity. Cephalad in the region of the frontal and temporal lobes of a normal brain is a wall of brain tissue, gray and white matter, 2 cm. thick, with, however, no gyri or sulci marked upon its external surface, and only one thickening on its internal surface. This thickening, taking origin at the cerebral peduncles, passed laterad and dorsad around the entire brain cavity like a misplaced hippocampus major. This thickening was 3 cm. deep and 15 mm. broad. Caudad to it, in the region normally occupied by the occipital lobes, the pia covered no brain tissue whatever. The brain tissue in front was covered by congeries of blood vessels on both of its surfaces, which vessels are continuous with large vessels coursing over the occipital walls, to vessels in the folds of a nearly normal tentorium cerebelli.

Cephalad to the thalamencephalon, extending ventrad from the abortive prosencephalon (if it can so be called), extended a nerve fiber to the rudimentary ethmoid plate in front,

through which two fibers were found passing. This appeared to be a rudimentary olfactory tract.

On horizontal section, the optic stalk extending cephalad 2 cm., divided into two stalks, each 1 cm. long, terminating in a well developed eyeball, choroid, sclera, lens, and external conjunctiva with rudimentary retina, vitreous and cornea, behind the outer canthus of the single ophthalmic slit. Mesially interposed between it and its fellow were two layers of muscle (probably internal recti), surmounted in front by the mass of granulation tissue above mentioned, entirely concealing the eye from external inspection. The optic stalk had no connection with the mesencephalon. The 12th, 11th, 10th, 9th, 8th, 7th and 5th nerves all seemed normally developed. The 4th nerve was present, but its connection cephalad was lost. The 3d nerve, divided normally, supplied a normal levator palpebrae muscle and its fibers passed to muscle tissue irregularly placed around an eyeball of which the orbit was deficient posteriorly, mesially, superiorly, and degenerate externally and inferiorly. The frontal branch was normal. The 6th nerve, of large size, passed normally to a degenerate set of muscle fibers inferior to the levator palpebrae. The muscle appeared to be unattached at either end.

The mouth seems normal. Rathke's diverticulum has closed off normally, leaving a pharynx closed cephalad above normally opening Eustachian tubes. Tooth sockets, normal.

Von Häcker, in the *Archiv für mikr. Anat.* at Bonn, in 1897, Vol. XLIX, pp. 35-91, has elaborately described the microscopical findings, while C. Claus, in 1892-3, elaborately described the embryology and comparative anatomy from the Zoölogical Institute of Vienna, Vol. X, pp. 283-356. Smith and Parker, of Philadelphia, have given one of the best descriptions in English of a case. In literature I counted some two hundred instances of this anomaly and then ceased to count. It is, therefore, moderately common. Its interest lies in the fact that it pursues no known laws of variation; it is not a reversion to some animal; its findings are quite regular and much alike; its causation obscure, and its influence on form, the influence of anomaly in one part over anomaly in another part. This anomaly may throw light on the formation of the gyri and sulci, and the non-relation of cerebellar to cerebral gyri, or cerebellar gyri to other gyri in its substance.

In the specimen here presented the interest lies in the

hidden position of the eyeballs, and the few complications with other variations.

Dareste, with whom began most of our systematic knowledge of cyclopiian monsters, despite the earlier work of Geoffroy Saint-Hilaire, stated that its probable cause was pressure of the amniotic sac. In the case here presented, the amniotic fluid was sufficient at birth, and membranes carefully examined showed no old adhesions. Rudolph's case of placenta adherent to brow, with normally formed eyes and nose, would seem, unless this attachment was secondary, to disprove this assertion. Phisalix, a student of Dareste, thought a thrombus of the vessel passing into the cleft or constriction between the primary fore-brain and primary mid-brain, to be responsible for the condition. The vessels in this subject, although uninjected, seem normal so far as the dissection has gone.

Cleland thought a hydrops of the pineal body or epiphysis was regularly responsible for the condition. In this case the epiphysis was much enlarged, but certainly contained no collection of fluid as was described in Cleland's case.

Ahlfeld surmised that in some of his cases hydrocephalus was responsible for the condition occurring before the differentiation of the primary fore-brain, as seems confirmed in Rochi's case with twins. It cannot be denied that this may be possible, but many cases of apparently early hydrocephalus without this anomaly would lend doubt to such supposition. Kunderat has shown that there may be an absence of the olfactory lobes and nerves without as necessary corollary the deformity of cyclopia. No case of cyclopia seems to have occurred where these two cerebral vesicles were present even if the corpus callosum was deficient and the two halves were more or less fused, as in Knox's fourteen cases of imperfectly divided brains.

Von Hippel has shown that the eye may be single; fused with one lens, two imperfect halves; fused, with two pupils, two lenses and one globe, fusion of two eyes, or, as in this case, two eyes with single stalk and embryonal tissue between, or two eyes with separate tracts and only the union of the fronto-nasal process to indicate the condition.

In the Museum of the Presbyterian Hospital, of New York City, I have seen a well developed foetus of about the thirty-eight week, a cyclops with fusion of two eyeballs on the ventral aspect. There is synotia as an additional abnormality

and deficient inferior mandibular process. In the Pathological Museum of the Medical Department of Columbia University, N. Y., I have seen a similar specimen, but the two pupils and lenses are in a single globe, and the synotie is more marked. These cases are exactly similar to the remarkably well described case of Smith & Parker, in Philadelphia, in 1884. Dareste maintained that cyclopia was common among pigs, while synotie was more common among sheep. Among references I have seen, however, it is quite as common among dogs, calves and sheep, as among pigs.

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THE MESIAL RELATIONS OF THE INFLECTED FISSURE. OBSERVATIONS UPON ONE HUNDRED BRAINS.

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Several cerebral morphologists have paid special attention to the so-called inflected fissure. Lussana of Padua first named it *solco inflesso*, while in America it was first noted by Professor Wilder¹, in 1885. The latter says of this fissure that it "indents the dorsi-mesal margin just cephalad of the precentral fissure and paracentral lobule. In the brain exhibited (from an adult mulatto) it is particularly distinct, and is shown in the outline figure in the *New York Medical Journal*, February 23, 1884, Fig. 42. It seems to have been described by Lussana and Lemoigne (*Fisiologia dei centri nervosi encefalici*, Padova, 1871) under the name of *solco inflesso*; paronymized, in Latin this becomes *fissura inflecta*, and in English the *inflected fissure*."

More recently, Eberstaller², in his work *Das Stirnhirn*, gives to this fissure the long name *sulcus praecentralis medialis*, which Wilder³ considers a "needless and unwarranted change of names," an opinion with which critical students will agree. However, Eberstaller commits another error, more grave, perhaps, than the one Professor Wilder has unearthed, inasmuch as it has misled many writers and perpetrated a misinterpretation which has existed in our literature to the present day. His error consists in the identification of Lussana's⁴ and Wilder's inflected (or Eberstaller's *sulcus praecentralis medialis*) with the fissure named by Broca *incisure pré-ovale*, and by Schwalbe *sulcus paracentralis*.

On referring to the writings of Broca and Schwalbe, it becomes evident that the pre-oval incisure and paracentral sulcus of these two writers does not correspond to the so-called inflected, but that both designations refer to the cephalic limb of Wilder's paracentral, a ramus for which Eberstaller himself

suggests the name *preparacental*. Broca⁵ describes it as an "*incisure pré-ovale* de la scissure sous-frontale," and the wood-cut illustration which accompanies his article, renders his meaning absolutely clear. Schwalbe⁶ likewise represents this as a ramus of the calloso-marginal, in Fig. 339 of his *Lehrbuch*, and beside the clear and accurate description of his *sulcus paracentralis* as a cephalic limiting ramus (on page 541), he expressly identifies this fissure with Broca's *incisure pré-ovale* (in a foot-note, page 544). The various synonyms for this ramus may therefore be properly grouped as follows:

<i>Incisure pré-ovale</i> ,	.	Broca.
<i>Sulcus paracentralis</i> ,	.	Schwalbe.
<i>Sulcus praeparacentralis</i> ,	.	Eberstaller.
<i>Cephalic paracentral limb</i> ,	.	Wilder.

In only 9 per cent. of the brains examined by me did I find this limb separated from the paracentral, and usually it was confluent with the *supercallosal* (Fig. 2). In the event of separation the interposed isthmus was invariably very narrow and insignificant, and in no case did I observe that this cephalic ramus ever crossed the dorsimesal margin. On the other hand, the true inflected fissure always cuts across the margin to appear on both meson and dorsum, and only in rare instances, contrary to Eberstaller, is it confluent with the paracentral (or "calloso-marginal"). On this point Eberstaller seems to contradict himself, for, after stating that the *sulcus praecentralis medialis* is situated caudad—by the breadth of one gyrus—of his "*Anfangsstück der Pars posterior*" of the "subfrontal," he thereupon says that these two fissures anastomose in 55 per cent. of his cases. What error of observation or interpretation underlies the latter statement, I cannot say. However that may be, his comments upon Schwalbe's description are based upon a gross misinterpretation, as inconsistent as it is erroneous.

We are dealing, then, with two distinct fissures which have been erroneously identified with each other ever since Eberstaller's work gained its wide circulation. The inflected fissure was probably unknown to Schwalbe under any name whatsoever, and it is unrepresented upon Ecker's diagrams⁷.

Through the kindness of Professor Wilder I have been enabled to study the work of Lussana and Lemoigne⁴ in which the fissure, which forms the subject of this paper, was first designated. The fissure is shown in Figs. 174, 177, 178

and 179. It is designated *solco inflesso* in Fig. 177 and *Sc. inflessa* (*Sc.* stands for *Scissura*) in Fig. 179. The relations in Fig. 174 are substantially as in Fig. 1 of this article. In Figs. 177 and 179 it is placed cephalad of the supercentral, while in Fig. 178 it is a little caudad, *i. e.*, just cephalad of the central.

The designation "*solco inflesso*" does not appear in the text, though the fissure is evidently described in four lines on page 163. Freely translated, it reads:

"The caudal part ('pezzo posteriore T') of the superfrontal gyrus ('appendice anteriore') exhibits an inflection (φ) on the middle of its mesial face ('*ha una inflessione media-interna* φ ') by means of which this gyrus is readily identified on the dorsal aspect, in man as well as in ruminants."

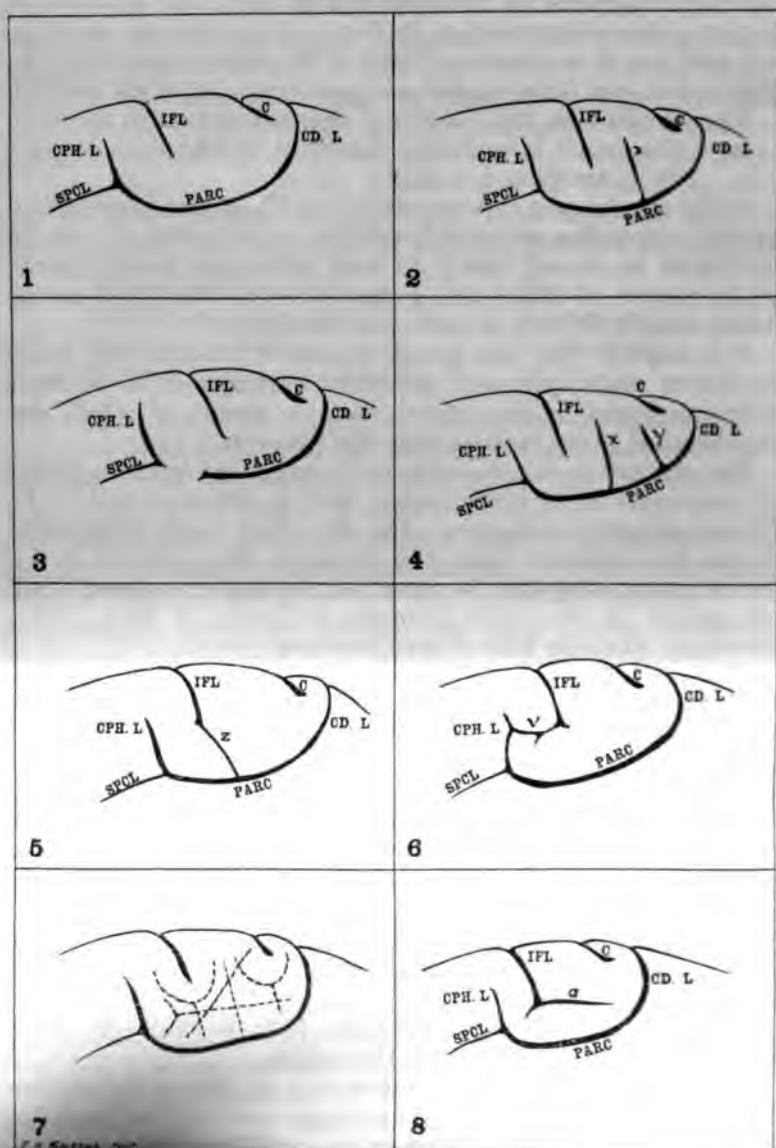
It is evident that this gyrus, named by Lussana the *pezzo posteriore della appendice anteriore*, corresponds to Wilder's inflected gyrus, or the lateral root, by means of which the superfrontal gyrus springs from the precentral gyrus.

The statement that the inflected is recognizable in the brains of ruminants lacks confirmation, both in literature and in the present writer's researches. On the other hand, Eberstaller denies its existence upon the brains of the primates (p. 65, *loc. cit.*), supposing him to mean thereby that it is absent upon the brains of the *other* primates, exclusive of man. This statement likewise fails of corroboration.

The contributions of Professor Wilder upon this subject have already been referred to. Flesch⁸ in 1885 designated it as the *x-fissure*, and with Familiant⁹ believed it homologous with the *cruciate fissure* of the carnivores. Benedikt's view¹⁰ is that the cruciate fissure is represented in man by both of the fissures discussed in this paper, at least so they are described; (1) on the meson, the anterior limiting fissure of the paracentral lobule; (2) on the dorsum, a transverse fissure which limits the superior part of the pre-central gyrus. As Wilder³ pointed out, one is left "in doubt as to whether the lateral fragment is the inflected fissure or the supercentral or some third fissure."

In opposition to these opinions, Betz is said¹¹ to favor *Broca's pre-oval incisure* with this claim.

Having shown, then, the importance of distinguishing between these fissures from a physiological as well as morphological standpoint, it will become apparent that the anatomical relations of these fissures are of equal importance, and with



this view I carried on the researches which form the basis of this paper, in the anatomical laboratory of the Medical Department of Columbia University. I am indebted to Professor George S. Huntington and Dr. B. B. Gallaudet for their courteous permission to examine one hundred brains of dissecting-room subjects. The brains had been hardened in formalin and were in a good stage of preservation.

Among the various fissural schemas with which I am acquainted, Professor Wilder's¹² is the only one which places the inflected cephalad of the cephalic paracentral limb. Wilder's figure was based upon the brain of a mulatto described by him in the Handbook article, and in the *New York Medical Journal*, February 23, 1884. That this extraparacentral position of the inflected is an anomalous and rare one will be seen in the latter part of this paper.

The brains were divided into two series of fifty each. Series I consisted in a tabulation of both the dorsal and mesial relations of the inflected, while Series II was recorded by means of drawings taken *ad naturam*, as being better adapted for future study as well as being of great aid in the proposed schematization of the fissures of this region.

Table I expresses the mesial relations of both series. Table II shows the dorsal relations of the fissure in the first series. Its absence was symmetrical (*i. e.*, on both halves) in 6 brains, or three per cent., while it occurred 22 times on the left, and 18 times on the right half.

TABLE I.

	I Series.		II Series.		Totals.	
	Cases.	Pr. ct.	Cases.	Pr. ct.	Cases.	Pr. ct.
Number of inflected fissures.....	77		83		160	80
Cephalic limb confluent with PARC	70	91	76	91½	146	91¼
Cephalic limb separated from PARC.....	7	9	7	8½	14	8¾
<i>a.</i> left h.....	3	4	4	5	7	4½
<i>b.</i> right h.....	4	5	3	3½	7	4½
There is only one cephalic limb.....	50	64	51	62	101	63
<i>a.</i> left h.....	23	30	24	30	47	30
<i>b.</i> right h.....	27	34	27	32	54	33
There is one additional ramus caud. of IFL.....	16	21	19	23	35	22
<i>a.</i> left h.....	6	8	11	13	17	11
<i>b.</i> right h.....	10	13	8	10	18	12
There are several rami (unclassified)	4	5	6	7	10	6

In brief, it was found that in 40 hemispheres of the 200 examined, the inflected was wanting; in other words, the fissure was present in 80 per cent.

All further data are based upon the 160 hemispheres, in which the fissure was present, as equivalent to 100.

In ninety-one per cent. the inflected was situated in a plane *caudad of an unmistakable cephalic paracentral limb*, while in the remaining nine per cent., this limb had become separated from the main paracentral stem by a narrow isthmus or slight vadium. But in all cases the inflected was situated caudad of this limb, whether separated or confluent, or, in other words, *the inflected indented and lay partly within the paracentral gyrus* (or *oval lobule*, as Broca prefers to call it). The reader will now understand the anomalous appearance of this region in Wilder's mulatto brain.

In sixty-three per cent. of all cases there was only one such limb or ramus, bounding the paracentral gyrus cephalad, as shown in Fig. 1; this arrangement occurred a little oftener upon the left half than upon the right.

In twenty-two per cent. there was an additional ramus, *intraparacentral* in nature, and probably also in origin, situated just caudad of the inflected, between it and the central. Fig. 3 will show how at first glance such a ramus might be mistaken for the true cephalic limiting ramus, and one must be guided by its position with reference to the inflected, as well as by the size of the lobule thus marked off. This intraparacentral ramus may afford a possible explanation for the odd arrangement on Wilder's mulatto brain; the small paracentral gyre is limited cephalad by such a ramus, while the true cephalic limb failed to develop (see Wilder's Fig. 4, 766. *Handbook*, Vol. VIII), so that the inflected fissure appears to lie wholly within the superfrontal gyrus. Fig. 4 is a copy.

In the remaining six per cent. the ramifications and disturbances of fissuration were so varied as not to allow readily of any classification. Sometimes there were two, or even three intraparacentral rami, or the paracentral itself was broken up into fissural segments.

As cited above, Eberstaller asserts that in fifty-five per cent. of his cases, the inflected (*s. præcentralis medialis*) anastomoses with the cephalic paracentral limb, or as he calls it, "*Anfangsstück der Pars posterior*," and "*s. præparacentralis*." I found such confluence in only two of the 160 hemispheres, both

between the muscularity of the individual and the degree and kind of fissuration of the paracentral gyrus.

The importance of determining with accuracy the anatomical relations of this region is based largely upon the fact that the cortical distribution of the motor neurones presiding over the movements of the lower limb is essentially confined, on the meson at least, to the paracentral gyrus as Betz, Schwalbe, Broca appear to have understood it. (See the excellent figure in L. F. Barker's "Nervous System", Plate 1¹⁴.)

As indicated above, the dorsal relations of the inflected were also considered in the first series. In the great majority of cases (eighty per cent.) the inflected was situated cephalad of the supercentral. (See Table II.)

In thirteen per cent. it was observed to indent a well-defined *inflected gyre* (Wilder) embraced by the dorsal radii of a bifurcated supercentral. This condition was symmetrical in three brains, and occurred oftener on the right half. In only six per cent. was the inflected caudad of the supercentral, *i. e.*, between the latter and the central fissure. In a few instances (number not noted) there was a superficial confluence with the supercentral, but a shallow *vadum* was always demonstrable.

TABLE II.—FIRST SERIES OF FIFTY BRAINS. DORSAL RELATIONS OF THE INFLECTED FISSURE.

Based on 77 hemispheres in which the fissure was present.

	Cases.	Pr. cent.
Cephalad of supercentral.....	62	80
<i>a.</i> left h.....	30	39
<i>b.</i> right h.....	32	41
<i>c.</i> both halves (sym.).....	22	28
Embraced by dorsal radii of supercentral.....	10	13
<i>a.</i> left h.....	4	5
<i>b.</i> right h.....	6	8
<i>c.</i> both halves (sym.).....	3	4
Caudad of supercentral.....	5	7
<i>a.</i> left h.....	3	4
<i>b.</i> right h.....	2	3
<i>c.</i> both halves (sym.).....	1	1

Although Wilder's terminology has been generally employed in this article, there appears to be room for more discussion upon some of the terms. Broca¹⁵, Mickle¹⁶, and others consider *oval lobule* to be less objectionable than *paracentral*

lobule, or *gyrus*, because this structure is not really "paracentral." For the terms *cephalic paracentral limb* and *caudal paracentral limb*, we might very well adopt *preparacentral* and *postparacentral*, retaining the name *paracentral* for the longitudinal stem.

In Fig. 9 the writer presents a schema, provisional, of course, of the fissures upon the mesial surface. It is a modification of Wilder's well-known schema, the changes being based upon the newer features which have become known and more or less accepted within the last decade.

It remains for the writer to express his indebtedness to many valuable hints given by Professor Wilder in correspondence while engaged upon this work, and to Professor Huntington and Dr. Gallaudet for the exceptional opportunities which their material and aid afforded me.

EXPLANATION OF THE FIGURES.

Fig. 1. Observed in sixty-three per cent. The inflected lies caudad of the only cephalic limb of the paracentral.

Fig. 2. Observed in twenty-two per cent. An additional ramus springs from the paracentral, just caudad of the inflected; this is probably one of the intraparacentral elements shown in Fig. 7, which has effected a superficial junction with the paracentral stem.

Fig. 3. Observed in eight and three-quarters per cent. Here the cephalic paracentral limb has been separated from the main stem by a narrow isthmus. In such cases this isolated limb is confluent with the supercallosal, as is indicated in the figure.

Fig. 4. The arrangement shown in this figure, *i. e.*, two intraparacentral rami, as well as other (unclassified) features, occurred in six per cent.

Fig. 5. Observed in nine out of one hundred and sixty hemicerebrums. (Less than six per cent.) The junction of the inflected with the paracentral commonly took place by means of the element Z, generally shallow.

Fig. 6. Observed in only two hemicerebrums, or one and one-quarter per cent. Eberstaller claims to have found this junction in fifty-five per cent!

Fig. 7. This figure shows the intraparacentral fissural elements, of which the writer has so far found five more or less definite types. Almost any combination or variation of these

elements may be found, but the longitudinal seems to be the commonest constant furrow.

Fig. 8. This shows the inflected joining the longitudinal intraprecuneal element marked "a."

Fig. 9. This figure represents the writer's schema of the fissures of mesial surface of the hemiserebrum.

ABBREVIATIONS.

The abbreviations used are the same for all the figures.

AMYG.,	.	.	.	Amygdaline f.
APRL.,	.	.	.	"Ascending pre-limbic f."
BS.,	.	.	.	Basisylvian f.
C.,	.	.	.	Central f.
CD. L.,	.	.	.	Caudal limb of PARC.
CL.,	.	.	.	Callosal f.
CLC.,	.	.	.	Calcarine f.
CLI.,	.	.	.	Collateral f.
CNT.,	.	.	.	Cuneate f.
CPH. L.,	.	.	.	Cephalic limb of PARC.
EOP'',	.	.	.	Exoccipital ["Preoccipital"] f.
FMG.,	.	.	.	Frontomarginal f.
HMP.,	.	.	.	Hippocampal f.
IFL.,	.	.	.	Inflected f.
IPRCN.,	.	.	.	Intraprecuneal f.
OC.,	.	.	.	Occipital f.
OCLC.,	.	.	.	Occipitocalcarine fissural stem.
PARC.,	.	.	.	Paracentral f.
PCLC.,	.	.	.	Postcalcarine f.
POCN.,	.	.	.	Postcuneal f.
RRCN.,	.	.	.	Precuneal f.
RST.,	.	.	.	Rostral f.
SBRST.,	.	.	.	Subrostral f.
SPCL.,	.	.	.	Supercallosal f.

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¹⁵ A. Broca. [See Note 5], pages 27 and 28.

¹⁶ W. J. Mickle [See Note 11], p. 556.

METHOD OF UTILIZING FROZEN SECTIONS FOR
CLASS DEMONSTRATIONS OF VISCERAL
ANATOMY AND ANATOMY OF
THE EPIPHYSES.

BY DR. A. PRIMROSE, TORONTO, CANADA.

The exhibition of lantern slides which was given before the Association of American Anatomists was that of a series of photographs made from sections through the trunk and extremities of children. The sections were prepared in a special manner so as to present a perfectly smooth surface with clear outlines of the various structures. These sections were photographed, and lantern plates made from the negatives. They were cut in sagittal, coronal and horizontal planes through the trunk, and in longitudinal and transverse directions through the extremities. The method adopted in the University of Toronto is that permanent preparations are made of the sections, which are mounted in flat dishes and thus exposed so that they are accessible to the students at any time in the Anatomical Department. The lantern demonstration of these sections is given from time to time at the close of a lecture. It proves to be a very useful adjunct to the ordinary methods of demonstration, and the student always has the opportunity of studying the actual sections in the dissecting room, the photograph of which is thrown upon the screen in the lecture theater. It is claimed that these photographs of actual sections are of much greater value from an educational standpoint than drawings reproduced from the sections.

My method of making the frozen sections referred to is as follows:

The subject must not be injected with alcohol, as that, of course, prevents freezing, but, if you wish, a colored injection may be thrown into the arteries. A wooden box is made, perforated with many holes so that water drains away from it readily. The subject is placed in the box and suspended in the position in which you wish to have it while cutting. The box must be sufficiently large to allow of about 18 inches of freezing mixture around the subject on all sides. The

freezing mixture is composed of ice and salt. The method I adopt for suspending the subject is as follows: An iron frame is made, rectangular in form and sufficiently long and broad to allow the subject to lie within it. My frame is 6 feet 6 inches long and 2 feet broad, and is supported at each end on iron supports 2 feet high. The frame must be strong enough to support the weight of the subject. A number of knobs are fastened to this iron frame. These knobs are separated 4 inches from one another all around the frame. A piece of ordinary factory cotton is used to suspend the subject, and this is readily tied to the knobs by strong twine. The value of this method is that one can readily obtain any degree of flexion of the head or of the spine or lower extremities by simply drawing upon the factory cotton and securing it to the knobs with the requisite amount of sagging in any one place to obtain the degree of flexion desired. The subject must remain in the box for about three days, when it ought to be frozen completely through and through. You then remove the subject from the box and cut it in the direction desired with an ordinary carpenter's saw. The sections should in no case be more than three-fourths of an inch in thickness. The section surface is cleaned off by pouring boiling water over it; thus all sawdust is removed, and it is then immediately immersed in alcohol of about 90 per cent. The sections should be left undisturbed in the *dirty* alcohol (for it becomes very "dirty") for a period of about two months at least, after which time they are taken out and thoroughly cleaned. They may subsequently be mounted in alcohol.

A CONTRIBUTION TO THE FISSURAL INTEGRALITY OF THE PAROCCIPITAL; OBSERVATIONS UPON ONE HUNDRED BRAINS.

BY EDWARD A. SPITZKA.

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I.

Chief among writers upon encephalic anatomy, Turner, Cunningham, Parker and Wilder, stand as exponents of several hypotheses concerning the status and origin of the paroccipital fissure. Turner¹ and Cunningham² consider it the *pars occipitalis* of an intraparietal complex composed of four factors. Wilder³ considers it a zygial fissural integer, his main point being its greatest depth at its middle, with no evidence of a transverse occipital at its caudal end more than at its cephalic, and with no approach to the parietal. Of more recent date is the work of Parker⁴. This author, taking into consideration the development of new conditions and pressure forces as cerebral growth continues, in a skull which assumes a more fixed and rigid shape, concludes that it is not a fissural integer at all, but merely a modification produced in the manner of connection of the originally confluent intraparietal and fissura perpendicularis externa, and that, for reasons pointed out by him, this so-called paroccipital is deepest at its middle point and gradually becomes shallower as it joins the intraparietal and backwardly displaced *fissura perpendicularis externa*.

The scope of this article does not permit me to go far into the details of Parker's argument, but I shall endeavor to give a brief account of his idea of the development of the fissure since it serves as the main basis for the present discussion.

I reproduce (Fig. 1) the conditions presented in the majority of the Simiadae, in diagrammatic form, and copied from A. J. Parker's Fig. 18. AB represents the intercerebral cleft; PO, the occipital ("parieto-occipital"); ip, the "intraparietal"; O', the exoccipital (*fiss. perp. externa*); P' and P² represent

the parietal and subparietal gyres, respectively, while O is the occipital lobe.

Now, as is well known, at some point near PO, but concealed within the depths of the fissure, "there develops in the monkeys, from its floor, a small bridging convolution"* and the external perpendicular fissure, O', is pushed backward just in proportion to the development of this gyrus. It is this gyrus which every one will recognize as Gratiolet's *première pli de passage*, attaining in man the dignity of a *paroccipital gyrus*, as it was first named by Professor Wilder.

We see, then, that Parker attaches some significance and value to the relative growth of this *pli de passage* in the subsequent formation of the paroccipital fissure and he advances the opinion (p. 336, *loc. cit.*) that all the *plis de passage* "are nothing but the posterior extremities of the occipito-frontal and occipito-temporal convolutions, which, checked in their development by the evolution of the occipital lobe in Primates, lie concealed in the majority of them by the overhanging operculum, whilst in the higher forms, through a renewed growth in this region, as we have seen in the case of the convolution 2 (Fig. 2 of this article) they finally reach the surface, displacing in their turn the operculum and pushing it backward."

The more one studies the morphology of the cerebral fissures and gyrus, the more apparent does the value of Gratiolet's *plis de passage* become, and it is to be regretted that Ecker⁵ should have rejected the name because they appeared to him to have no "justification in the human brain."

Parker does not proceed further in his very excellent argument though he might easily have done so and assigned an equally important rôle to the *deuxième pli de passage*. It is also evident that he considers the caudal rami (or the transverse piece called by Ecker the *S. occipitalis transversus*) as the human representative of a portion of the simian exoccipital.

If we take up the discussion at the point where Parker left it, it can be readily understood how a simultaneous up-growth of the *deuxième pli de passage* would serve to limit the ectal extension of such a paroccipital, always bearing in mind that it must be regarded as a segment of the simian exoccipital. The chief difficulty that we encounter then is that we have

* Parker, p. 321.

a zygon of variable length to deal with and one directed generally transversely to the course of the exoccipital fissure.

Let us assume that the growth of both the *première* and *deuxième plis de passage* takes place simultaneously; if we begin with the conditions as they exist in most of the simiadae, as in Fig. 1, such development will result in the isolation of a segment of the exoccipital situated between the two plis and forming the "proton" (anlage) for a paroccipital zygal fissure. Parker has shown (p. 335, *loc cit.*) how a combination of expansive forces and resisting forces controls the development of such zygal as well as of the triradiate and quadriradiate fissures, applying for this purpose the principles deduced by the eminent physicist Plateau⁶. In brief, he finds a stable equilibrium in the zygal form due to the apposition of four plastic spheres (Plateau's experiments were done by means of soap-bubbles floating on water or upon a glass plate). In the brain the four spheres which are here crowded together are represented in the following four elements:

- I. Première pli de passage.
- II. Deuxième pli de passage.
- III. Occipital lobe.
- IV. Parietal lobe.

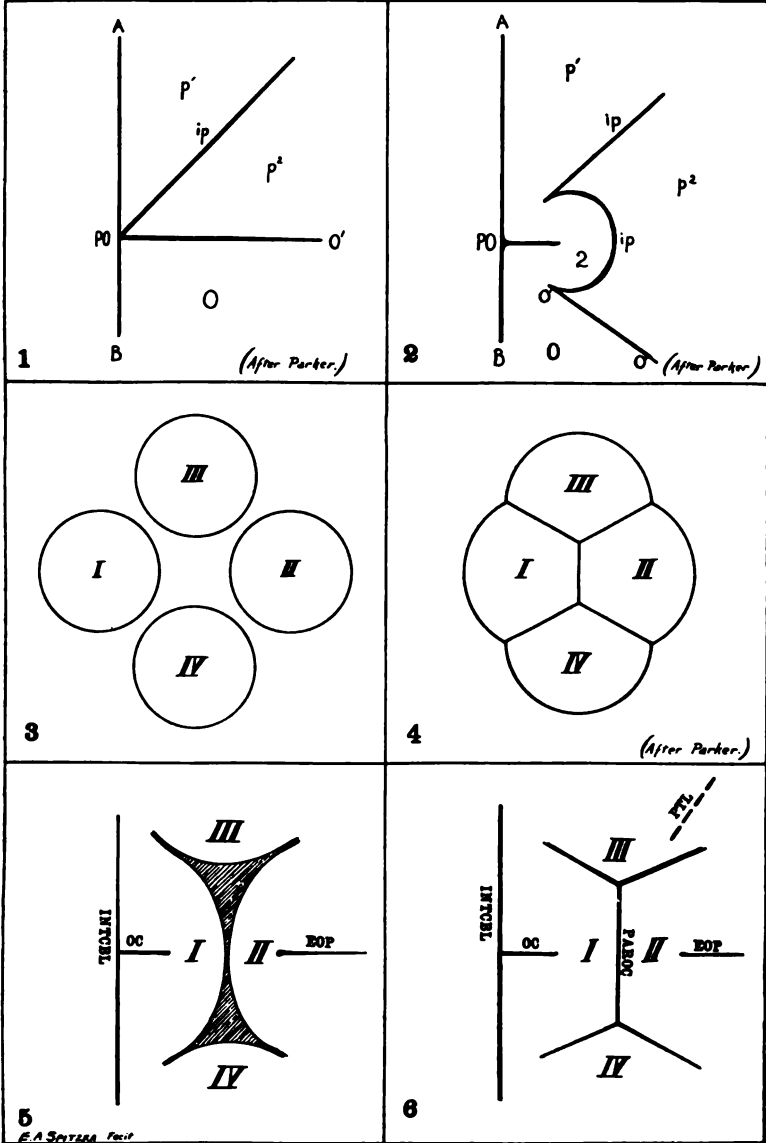
Development and growth takes place more forcibly and more rapidly on the part of elements I and II, and hence these crowd together before III and IV could, the result being a zygal fissure whose zygon or stem runs in a transverse direction to the course of the interrupted exoccipital. A rapid review of these developments resolves itself into the following:

First: An unbroken continuity of the mesial occipital with the exoccipital fissure, (as in most forms of Simiadae).

Second: A simultaneous up-growth of the *première* and *deuxième plis de passage* of Gratiolet, bridging the exoccipital and including between them a fissural segment of the exoccipital, forming the basis or *anlage* for the future paroccipital.

Third: An increased growth of these two *plis*, crowding upon each other while at the same time pushing apart the occipital and parietal lobar parts at this site, giving rise to the zygon or stem.

Fourth: The accompanying, though lesser, resistance of the parietal and occipital elements, situated cephalad and cau-



dad, giving rise to the rami and stipes of Professor Wilder's description.

The questions involved are, then : Is the paroccipital a true fissural integer or not ; if not, of what fissure is it a part ?

Turner and Cunningham evidently consider its main portion a part of the intraparietal while its caudal rami represent a segment of the "*Affenspalte*", equivalent to Ecker's *transverse occipital* and Eberstaller's *S. occipitalis anterior*. Wilder's idea of integrality has already been referred to. Parker strongly urges that it is a part of the external perpendicular fissure (exoccipital) with an accompanying modification of its junction, at that site, with the "intraparietal" (parietal f.) but he likewise believes the caudal transverse piece to represent a persistent segment of the fundamental exoccipital as his Fig. 19 (Fig. 2 of this article) shows. Nevertheless, Parker's idea, with the elaborations and modifications of the present writer, appears to be the true one, and the comparative frequency of confluence or separation of the parietal and paroccipital fissures involves a question of only secondary importance. In the second part of this paper these relations are considered at length.

In the endeavor to explain the causation of this zygial fissure, it is just possible that this writer may be understood to advocate the old theory advanced by Ecker, that the formation of convolutions is the necessary consequence of mechanical processes. This theory, so far as the typical cerebral pattern is concerned, has been abandoned by most morphologists, and rightly so. "Mechanical packing," as a cause of the cerebral configurations is probably by far the least important, physiologically as well as morphologically. But I do maintain, however, that so far as zygial fissures are concerned, especially if they represent gaps in what was once a continuous fissure or cleft, the dynamic factors are of great, if not of paramount importance.

The importance of seeking corroborative evidence for these propositions in an extended research upon the appearances and conditions existing in the brains of foetuses, both human and anthropoid, will have become as apparent to the reader as it did to the writer. The essays of various investigators so far published while all of great value and deserving of much praise, are still insufficient for accurate generalizations and definitions. However, macroscopic and developmental en-

cephalic anatomy promises to regain the important position which it occupied prior to the advent of the discoveries in histological methods which attracted the great majority of original workers in the latter part of the nineteenth century.

II.

While engaged in the study of this fissure, I followed out the suggestions of Professor Wilder and tabulated the number of confluences and separations in one hundred brains taken from dissecting-room subjects in the Medical Department of Columbia University. For this privilege I am indebted to Professor G. S. Huntington and Dr. B. B. Gallaudet, chief demonstrator of anatomy.

In the classification of these results I follow Professor Wilder's method, namely, that of distributing all possible conditions under four heads, as follows:

- Class I. Left continuity, right separation.
- Class II. Left and right continuity.
- Class III. Left and right separation.
- Class IV. Left separation, right continuity.

In the present researches the results obtained were:

Class I,	.	.	.	32 per cent.
Class II,	.	.	.	45 per cent.
Class III,	.	.	.	17 per cent.
Class IV,	.	.	.	6 per cent.

There is a continuity in sixty-four per cent. of all hemispheres, and separation in thirty-six per cent., as follows:

	Continuity.	Separation.
Left hemisphere.....	77 per cent.	23 per cent.
Right hemisphere.....	51 per cent.	49 per cent.

Continuity and separation were symmetrical (*i. e.*, upon both halves of the same brain) in sixty-two per cent., while asymmetrical conditions prevailed in the remaining thirty-eight per cent.

For convenience of comparison I present a table showing in the first column Professor Wilder's figures derived from

his "Lecture Notes for 1900"; in the second column those obtained by the writer.

	I.—B. G. WILDER.	II.—E. A. SPITZKA.
Class I.....	44 per cent.	32 per cent.
Class II.....	33 per cent.	45 per cent.
Class III.....	17 per cent.	17 per cent.
Class IV.....	6 per cent.	6 per cent.
Continuity (all cases).....	58 per cent.	64 per cent.
Separation (all cases).....	42 per cent.	36 per cent.
Left continuity.....	77 per cent.	77 per cent.
Left separation.....	23 per cent.	23 per cent.
Right continuity.....	39 per cent.	51 per cent.
Right separation.....	61 per cent.	49 per cent.
Symmetry.....	50 per cent.	62 per cent.
Asymmetry.....	50 per cent.	38 per cent.

It will be observed that in general the results are similar. The exceptional cases are an inversion of the percentages of classes I and II, a greater frequency of continuity in all cases (second column) and a greater frequency of symmetrical conditions, perhaps due to the average lower grade of the brains at my disposal.

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ON THE TEACHING OF THE NORMAL ANATOMY OF THE CENTRAL NERVOUS SYSTEM OF HUMAN BEINGS TO LARGE CLASSES OF MEDICAL STUDENTS.

BY LEWELLYS F. BARKER, M. B., AND PRESTON KYES, M. D.

The writers had this past autumn to meet the problem of teaching 220 sophomore students the anatomy of the brain and spinal cord of human beings, in the absence of a sufficient amount of illustrative anatomical material, and with a corps of instructors of inadequate size. Less than twenty human brains were obtainable, and only four instructors, in addition to the lecturer, were available for laboratory teaching. The class was dealt with in the following way:

Two lectures were given weekly for three months. A few extra lectures were arranged for toward the end of the course. The lectures consisted of brief descriptions of the parts actually to be studied in the laboratory, accompanied by demonstrations of the parts and colored blackboard drawings. At the end of the courses, lectures upon the various conduction paths were given. The nomenclature employed was that of the B.N.A.

For the laboratory work two sessions of from one and a-half to two hours each were available weekly for each of the four sections into which the class was divided. An instructor was placed in charge of each laboratory section, and to make up for the lack of additional trained instructors, laboratory outlines were printed on library cards and distributed from time to time to each member of the class. No attempt was made to make one laboratory card correspond to one session of laboratory work. On the contrary, each card contained an outline of a certain portion of the course. This card was used until the corresponding portion of the work had been completed, a new card then being given out.

The number of brains, though small, was made to suffice, in that one brain was given to each twelve students. It was cut into four parts (1, right cerebral hemisphere; 2, left cerebral hemisphere; 3, cerebellum; 4, brain stem). Three students worked on each part, making drawings of the external form from different aspects, the parts being exchanged until each

of the twelve members of the group had made drawings of the naked-eye appearance of the whole external surface of the brain. Subsequently each brain was cut into a series of coronal sections at the levels indicated in the cards. Each of these sections was imbedded in a flat disk of plaster of paris and kept in a weak solution of formaline. These sections were distributed among the students, who drew them, the various sections being exchanged until each student had drawn all of them. The students were advised to use the lecture notes, an atlas (preferably Spalteholz' Toldt's), and a good text as guides to their laboratory work.

The most discouraging part of the course for the student was the drawing of the long series of coronal sections, especially through the region of the mid-brain, pons and medulla. During this period the student has to learn a large number of names for the various objects which are visible before he appreciates the significance of this knowledge for the conception of the nervous system in the three dimensions of space necessary for the proper understanding of the various conduction paths.

When the series of drawings had been completed lectures were given upon the various conduction paths, especially upon those of most importance to practical medical men, and the student was required to make diagrammatical sketches illustrating these various paths and the neurone systems composing them, relating each of the masses of nerve cells and each of the bundles of medullated axones to the structures which he had seen and drawn when passing through the series of coronal sections.

The following is the series of cards furnished each student, indicating the outline of the course as given :

OUTLINE NO. I.

SYSTEMA NERVORUM CENTRALE OF THE DOG.

Gross Study.

DIRECTIONS : Identify the following structures by a study of the projected animal :

<i>Syst. Nerv. Centrale.</i>	<i>Syst. Nerv. Periphericum.</i>	<i>Syst. Nerv. Sympathici.</i>
<i>Meninges</i>	<i>Nervi cerebrales</i>	<i>Truncus sympathicus</i>
<i>Cerebrum</i>	<i>Nervi spinales</i>	<i>Ganglia trunci sympathici</i>
<i>Cerebellum</i>	<i>Rami communicantes</i>	<i>Plexus sympathici</i>
<i>Medulla oblongata</i>		<i>Ganglia plexuum sympathicorum</i>
<i>Medulla spinalis</i>		

OUTLINE NO. 2.

SYSTEMA NERVORUM CENTRALE OF EMBRYO FIG.

Gross Study.

DIRECTIONS: Place the embryo flat on the abdomen with limbs extended. Make an incision in the mid-dorsal line the entire length of the animal. Dissect and remove the soft parts adjacent to the *columna vertebralis* working laterally from the median line.

Expose the *medulla spinalis* by removing the vertebral arches with forceps and scissors, taking care to avoid the underlying soft parts.

Expose the *encephalon* by removing the skull cap.

Draw the *systema nervorum centrale* as thus exposed with the *meninges* intact.

Attach to drawings the names of all visible structures mentioned in the nomenclature [B.N.A.].

Preserve the specimen in a four per cent. solution of formaldehyde.

OUTLINE NO. 3.

SYSTEMA NERVORUM CENTRALE OF EMBRYO FIG.

Gross Study.

Eviscerate the embryo through a median ventral incision. Note the chain of ganglia on either side of the *columna vertebralis*. Trace fibers from the ganglia through the body wall to the peripheral nerve trunks—*rami communicantes*. Note the extensive radiation of peripheral fibers from the ganglia. Draw three ganglia with their several connecting fibers.

With the embryo flat on the abdomen, expose the *nervi spinales* for a short distance beyond their exit from the *columna vertebralis*.

Dissect each *oculus* from its orbit, leaving it attached only to the *encephalon* by the *nervus opticus*.

Remove the *medulla spinalis* and *encephalon* intact after sectioning the peripheral attachments and laying open the *dura mater*.

Draw the ventral and lateral aspects of the system thus isolated.

Attach to drawings the names of all visible structures mentioned in the nomenclature [B.N.A.].

Preserve the specimen in a four per cent. solution of formaldehyde.

OUTLINE NO. 4.

ENCEPHALON OF MAN.

Gross Study.

Divide the human encephalon into four parts as follows:

Remove the *prosencephalon* by sectioning the *pedunculi cerebri*, and separate its symmetrical halves by division of the *corpus callosum*. Remove the *cerebellum* from the *rhombencephalon* by cutting the *brachia conjunctiva*, the *brachia pontis* and the *corpora restiformia*.

Make drawings of the isolated parts as follows:

1. *Prosencephalon*; median, lateral, dorsal and ventral aspects.

2. *Rhombencephalon* (minus the *cerebellum*); dorsal, ventral and lateral aspects.

3. *Cerebellum*; dorsal, ventral and anterior aspects.

Attach to drawings the names of all visible structures mentioned in the nomenclature [B.N.A.].

Preserve the specimens in a four per cent. solution of formaldehyde.

OUTLINE NO. 5.

ENCEPHALON OF MAN.

Gross Study.

DIRECTIONS: With the accompanying diagram as a guide, divide the *prosencephalon* into eight lamellae by transverse sections as follows:

Section I, to pass through the middle of the *lobus frontalis* immediately anterior to the *ventriculus lateralis* and the *genu corporis callosi*.

Section II, to pass through the anterior extremity of the *ventriculus lateralis* and the *caput nuclei caudati*.

Section III, to pass immediately posterior to the *commissura anterior*.

Section IV, to pass through the middle of the *thalamus*.

Section V, to pass through the *commissura posterior*.

Section VI, to pass through the *splenium corporis callosi*.

Section VII, to pass through the middle of the *lobus occipitalis*.

Refer to the diagram on the other side of this card.

Preserve the specimens in a four per cent. solution of formaldehyde.



OUTLINE NO. 6.

ENCEPHALON OF MAN.

Gross Study.

DIRECTIONS: Draw either of the coronal surfaces exposed by section I*, giving especial attention to the following structures:

<i>Substantia grisea</i>	<i>Gyrus frontalis superior</i>	<i>Sulcus frontalis inferior</i>
<i>Substantia alba</i>	<i>Sulcus frontalis superior</i>	<i>Gyrus frontalis inferior</i>
<i>Fissura longitudinalis cerebri</i>	<i>Gyrus frontalis medius</i>	<i>Sulcus olfactorius</i>

Draw either of the coronal surfaces exposed by section II*, giving especial attention to the following structures:

<i>Corpus callosum</i>	<i>Gyrus frontalis medius</i>	<i>Cornu anterius ventriculi lateralis</i>
<i>Fissura longitudinalis cerebri</i>	<i>Sulcus frontalis inferior</i>	<i>Septum pellucidum</i>
<i>Sulcus corporis callosi</i>	<i>Gyrus frontalis inferior</i>	<i>Caput nuclei caudati</i>
<i>Gyrus cinguli</i>	<i>Fissura cerebri lateralis</i>	<i>Capsula interna</i>
<i>Gyrus frontalis superior</i>	<i>Lobus temporalis</i>	<i>Clastrum</i>
<i>Sulcus frontalis superior</i>	<i>Nervus opticus</i>	<i>Capsula</i>

Refer to Outline No. 5.

Attach to the drawings the names of all visible structures mentioned in the nomenclature [B.N.A.].

Preserve the specimens in a four per cent. solution of formaldehyde.

OUTLINE NO. 7.

ENCEPHALON OF MAN.

Gross Study.

DIRECTIONS: Draw either of the coronal surfaces exposed by section III*, giving especial attention to the following structures:

<i>Corpus callosum</i>	<i>Lobus temporalis</i>	<i>Substantia perforata</i>
<i>Fissura longitudinalis cerebri</i>	<i>Gyrus temporalis superior</i>	<i>anterior</i>
<i>Sulcus corporis callosi</i>	<i>Sulcus temporalis superior</i>	<i>Ventriculus lateralis</i>
<i>Gyrus cinguli</i>	<i>Gyrus temporalis medius</i>	<i>Cornu anterius</i>
<i>Sulcus cinguli</i>	<i>Sulcus temporalis medius</i>	<i>Septum pellucidum</i>
<i>Gyrus frontalis superior</i>	<i>Gyrus temporalis inferior</i>	<i>Columna fornicis</i>
<i>Sulcus frontalis superior</i>	<i>Sulcus temporalis inferior</i>	<i>Ventriculus tertius</i>
<i>Gyrus frontalis medius</i>	<i>Gyrus fusiformis</i>	<i>Commissura anterior</i>
<i>Sulcus frontalis inferior</i>	<i>Fissura collateralis</i>	<i>Nucleus caudatus</i>
<i>Gyrus frontalis inferior</i>	<i>Gyrus hippocampi</i>	<i>Capsula interna</i>
<i>Fissura cerebri lateralis</i>	<i>Uncus</i>	<i>Globus pallidus</i>
[Sylvii]	<i>Nucleus amygdalae</i>	<i>Putamen</i>
<i>Gyri insulae</i>	<i>Tractus opticus</i>	<i>Capsula externa</i>
	<i>Infundibulum</i>	<i>Clastrum</i>

Attach to the drawing the names of all visible structures mentioned in the nomenclature [B.N.A.].

Preserve the specimen in a four per cent. solution of formaldehyde.

OUTLINE NO. 8.

ENCEPHALON OF MAN.

Gross Study.

DIRECTIONS: Draw either of the coronal surfaces exposed by section IV*, giving especial attention to the following structures:

<i>Corpus callosum</i>	<i>Gyri insulae</i>	<i>Ventriculus lateralis</i>
<i>Fissura longitudinalis cerebri</i>	<i>Gyrus temporalis superior</i>	<i>Columna fornicis</i>
<i>Sulcus corporis callosi</i>	<i>Sulcus temporalis superior</i>	<i>Plexus chorioideus</i>
<i>Gyrus cinguli</i>	<i>Gyrus temporalis medius</i>	<i>Hippocampus</i>
<i>Sulcus cinguli</i>	<i>Sulcus temporalis medius</i>	<i>Ventriculus tertius</i>
<i>Gyrus frontalis superior</i>	<i>Gyrus temporalis inferior</i>	<i>Fossa interpeduncularis</i>
<i>Sulcus frontalis superior</i>	<i>Sulcus temporalis inferior</i>	
<i>Gyrus frontalis medius</i>	<i>Gyrus fusiformis</i>	<i>Nucleus caudatus</i>
<i>Sulcus praecentralis</i>	<i>Fissura collateralis</i>	<i>Thalamus</i>
<i>Gyrus centralis anterior</i>	<i>Gyrus hippocampi</i>	<i>Capsula interna</i>
<i>Sulcus centralis</i>	<i>Sulcus hippocampi</i>	<i>Globus pallidus</i>
<i>Gyrus centralis posterior</i>	<i>Uncus</i>	<i>Putamen</i>
<i>Fissura cerebri lateralis</i>	<i>Tractus opticus</i>	<i>Capsula externa</i>
<i>Insula</i>	<i>Cauda nuclei caudati</i>	<i>Clastrum</i>

Attach to the drawing the names of all visible structures mentioned in the nomenclature [B.N.A.].

Preserve the specimen in a four per cent. solution of formaldehyde.

* Refer to Outline No. 5.

OUTLINE NO. 9.

ENCEPHALON OF MAN.

Gross Study.

DIRECTIONS : Draw either of the coronal surfaces exposed by section V*, giving especial attention to the following structures :

<i>Corpus callosum</i>	<i>Gyrus temporalis medius</i>	<i>Hippocampus</i>
<i>Fissura longitudinalis cerebri</i>	<i>Sulcus temporalis medius</i>	<i>Plexus chorioideus</i>
<i>Sulcus corporis callosi</i>	<i>Gyrus temporalis inferior</i>	<i>Fornix</i>
<i>Gyrus cinguli</i>	<i>Sulcus temporalis inferior</i>	<i>Ventriculus tertius</i>
<i>Sulcus cinguli</i>	<i>Gyrus fusiformis</i>	<i>Commissura posterior</i>
<i>Gyrus centralis anterior</i>	<i>Fissura collateralis</i>	<i>Fossa interpeduncularis</i>
<i>Sulcus centralis</i>	<i>Gyrus hippocampi</i>	<i>Striae medullaris</i>
<i>Gyrus centralis posterior</i>	<i>Fissura hippocampi</i>	<i>Thalamus</i>
<i>Fissura cerebri lateralis</i>	<i>Fascia dentata hippocampi</i>	<i>Capsula interna</i>
<i>Gyrus temporalis superior</i>	<i>Cauda nuclei caudati</i>	<i>Pedunculus cerebri</i>
<i>Sulcus temporalis superior</i>	<i>Ventriculus lateralis</i>	

Attach to the drawing the names of all visible structures mentioned in the nomenclature [B.N.A.].

Preserve the specimen in a four per cent. solution of formaldehyde.

OUTLINE NO. 10.

ENCEPHALON OF MAN.

Gross Study.

DIRECTIONS : Draw either of the coronal surfaces exposed by section VI*, giving especial attention to the following structures :

<i>Corpus callosum</i>	<i>Lobulus parietalis inferior</i>	<i>Ventriculus lateralis</i>
<i>Fissura longitudinalis cerebri</i>	<i>Fissura cerebri lateralis</i>	<i>Cornu posterius</i>
<i>Radiatio corporis callosi</i>	<i>Gyrus temporalis superior</i>	<i>Bulbus cornu posterius</i>
<i>Sulcus corporis callosi</i>	<i>Sulcus temporalis superior</i>	<i>Calcar avis</i>
<i>Gyrus cinguli</i>	<i>Gyrus temporalis medius</i>	<i>Hippocampus</i>
<i>Sulcus cinguli</i>	<i>Sulcus temporalis medius</i>	<i>Tapetum</i>
<i>Gyrus centralis anterior</i>	<i>Gyrus temporalis inferior</i>	<i>Radiatio occipitothalamica</i>
<i>Sulcus centralis</i>	<i>Sulcus temporalis inferior</i>	<i>Eminentia collateralis</i>
<i>Gyrus centralis posterior</i>	<i>Gyrus fusiformis</i>	<i>Glomus chorioideum</i>
<i>Sulcus interparietalis</i>	<i>Fissura collateralis</i>	
	<i>Gyrus lingualis</i>	

Attach to the drawing the names of all visible structures mentioned in the nomenclature [B.N.A.].

Preserve the specimen in a four per cent. solution of formaldehyde.

OUTLINE NO. 11.

ENCEPHALON OF MAN.

Gross Study.

DIRECTIONS : Draw either of the coronal surfaces exposed by section VII*, giving especial attention to the following structures :

* Refer to Outline No. 5.

<i>Fissura longitudinalis cerebri</i>	<i>Sulcus temporalis medius</i>	<i>Glomus chorioideum</i>
<i>Lobulus parietalis superior</i>	<i>Gyrus temporalis inferior</i>	<i>Hippocampus</i>
<i>Sulcus interparietalis</i>	<i>Sulcus temporalis inferior</i>	<i>Calcar avis</i>
<i>Lobulus parietalis inferior</i>	<i>Gyrus fusiformis</i>	<i>Eminentia collateralis</i>
<i>Fissura cerebri lateralis</i>	<i>Fissura collateralis</i>	<i>Bulbus cornu posterioris</i>
<i>Gyrus temporalis superior</i>	<i>Gyrus lingualis</i>	<i>Tapetum</i>
<i>Sulcus temporalis superior</i>	<i>Fissura calcarina</i>	<i>Radiatio occipitothalamica</i>
<i>Gyrus temporalis medius</i>	<i>Ventriculus lateralis</i>	
	<i>Cornu posterius</i>	

Attach to the drawing the names of all visible structures mentioned in the nomenclature [B.N.A.].

Preserve the specimen in a four per cent. solution of formaldehyde.

OUTLINE NO. 12.

ENCEPHALON OF MAN.

Gross Study.

DIRECTIONS: With the accompanying diagram as a guide, divide the *rhombencephalon* into nine lamellae by transverse sections as follows:

Section VIII to pass through the *colliculi superiores* of the *corpora quadrigemina* and the *pedunculi cerebri*.

Section IX to pass through the inferior portion of the *colliculi superiores* of the *corpora quadrigemina*.

Section X to pass through the *colliculi inferiores* of the *corpora quadrigemina*.

Section XI to pass through the principal motor nucleus of the *n. trigeminus*.

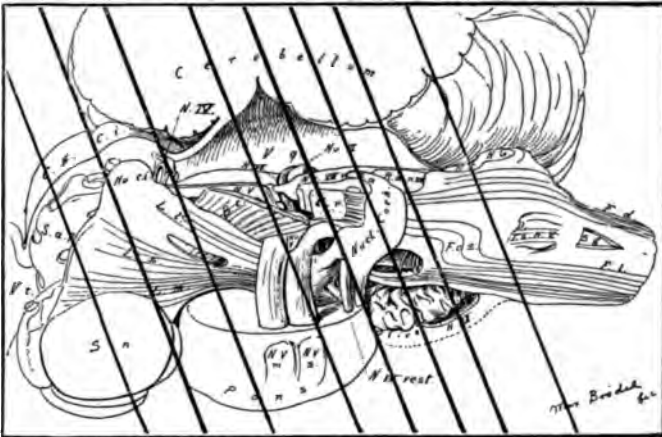
Section XII to pass through the area of entrance of the *n. cochleæ*.

Section XIII to pass through the middle of the *nucleus olivaris inferior* and the *nucleus n. cochlearis dorsalis*.

Section XIV to pass through the spinal extremity of the *nucleus olivaris inferior*.

Section XV to pass through the level of the *decussatio lemniscorum*.

Preserve the specimen in a four per cent. solution of formaldehyde.



OUTLINE NO. 13.

ENCEPHALON OF MAN.

Gross Study.

DIRECTIONS: Draw either of the coronal surfaces exposed by section VIII*, giving especial attention to the following structures:

<i>Colliculi superiores</i>	<i>Decussatio tegmenti dorsalis</i>	<i>Basis pedunculi</i>
<i>Aqueductus cerebri</i>		<i>Fasciculi cerebrospinales</i>
<i>Stratum griseum centrale</i>	<i>Nucleus n. oculomotorii</i>	<i>Fasciculus palliopontilis</i>
<i>Stratum album profundum</i>	<i>N. oculomotorius</i>	(<i>pars frontalis</i>)
	<i>Nucleus ruber</i>	<i>Fasciculus palliopontilis</i>
<i>Fasciculus longitudinalis medialis</i>	<i>Lemniscus medialis</i>	(<i>pars temporooccipitalis</i>)
	<i>Substantia nigra</i>	

Draw either of the coronal surfaces exposed by section IX*, giving especial attention to the following structures:

<i>Colliculi superiores</i>	<i>Decussatio tegmenti ventralis</i>	<i>Nucleus lateralis superior</i>
<i>Aqueductus cerebri</i>		[<i>Flechsigi</i>]
<i>Stratum griseum centrale</i>	<i>Decussatio brachii conjunctivi</i>	<i>Lemniscus medialis</i>
<i>Stratum album profundum</i>	<i>Nucleus n. trochlearis</i>	<i>Substantia nigra</i>
<i>Fasciculus longitudinalis medialis</i>	<i>N. trochlearis</i>	<i>Pars basilaris pontis</i>
		<i>Fasciculi cerebrospinales</i>

Attach to the drawings the names of all visible structures mentioned in the nomenclature [B.N.A.].

Preserve the specimens in a four per cent. solution of formaldehyde.

OUTLINE NO. 14.

ENCEPHALON OF MAN.

Gross Study.

DIRECTIONS: Draw either of the coronal surfaces exposed by section X*, giving especial attention to the following structures:

<i>Colliculi inferiores</i>	<i>Fasciculus longitudinalis medialis</i>	<i>Lemniscus lateralis</i>
<i>Nucleus colliculi inferioris</i>	<i>N. trochlearis</i>	<i>Brachia conjunctiva</i>
<i>Aqueductus cerebri</i>	<i>Nucleus centralis superior</i>	<i>Lemniscus medialis</i>
<i>Stratum griseum centrale</i>	<i>pars centralis</i>	<i>Pars basilaris pontis</i>
<i>Radix descendens n. trigemini</i>	<i>pars lateralis</i>	<i>Fasciculi cerebrospinales</i>

Draw either of the coronal surfaces exposed by section XI*, giving especial attention to the following structures:

<i>Cerebellum</i>	<i>Fasciculus longitudinalis medialis</i>	<i>Nuclei motorii minores n. trigemini</i>
<i>Pons</i>	<i>Lemniscus medialis</i>	<i>Nucleus motorius princeps n. trigemini</i>
<i>Pars dorsalis</i>	<i>Corpus trapezoidenum</i>	<i>Radix descendens n. trigemini</i>
<i>Ventriculus quartus</i>	<i>Nucleus olivaris superior</i>	<i>Substantia gelatinosa</i>
<i>Stratum griseum centrale</i>	<i>N. abducens</i>	<i>Pars basilaris</i>
<i>Brachia conjunctiva</i>	<i>N. trigeminus</i>	<i>Fasciculi cerebrospinales</i>
<i>Radix descendens n. trigemini</i>		

* Refer to Outline No. 12.

Attach to the drawings the names of all visible structures mentioned in the nomenclature [B.N.A.].

Preserve the specimens in a four per cent. solution of formaldehyde.

OUTLINE NO. 15.

ENCEPHALON OF MAN.

Gross Study.

DIRECTIONS : Draw either of the coronal surfaces exposed by section XII *, giving especial attention to the following structures :

<i>Cerebellum</i>	<i>N. glossopharyngeus</i>	<i>Nucleus n. cochleae ventralis</i>
<i>Medulla oblongata</i>	<i>N. vagus</i>	
<i>Ventriculus quartus</i>	<i>Nucleus n. vestibuli superior</i>	<i>Nucleus olivaris inferior</i>
<i>Brachia conjunctiva</i>		<i>Stratum interolivare lemnisci</i>
<i>Corpora restiformia</i>	<i>Nucleus n. vestibuli medialis</i>	<i>Radix descendens n. vestibuli</i>
<i>Fasciculus longitudinalis medialis</i>	<i>Tractus spinalis n. trigemini</i>	<i>Fasciculi cerebrospinales</i>
<i>Nucleus centralis inferior</i>		
<i>N. cochleae</i>	<i>Pedunculus flocculi</i>	

Draw either of the coronal surfaces exposed by section XIII *, giving especial attention to the following structures :

<i>Cerebellum</i>	<i>N. glossopharyngeus</i>	<i>Nucleus tractus solitarii</i>
<i>Medulla oblongata</i>	<i>N. vagus</i>	<i>Radix descendens n. vestibuli</i>
<i>Ventriculus quartus</i>	<i>N. hypoglossus</i>	
<i>Nucleus dentatus</i>	<i>Nucleus n. cochleae dorsalis</i>	<i>Stratum interolivare lemnisci</i>
<i>Corpora restiformia</i>	<i>Nucleus n. vestibuli medialis</i>	
<i>Fasciculus longitudinalis medialis</i>	<i>Pedunculus flocculi</i>	<i>Fasciculi cerebrospinales</i>
	<i>Nucleus olivaris inferior</i>	

Attach to the drawings the names of all visible structures mentioned in the nomenclature [B.N.A.].

Preserve the specimens in a four per cent. solution of formaldehyde.

OUTLINE NO. 16.

ENCEPHALON OF MAN.

Gross Study.

DIRECTIONS : Draw either of the coronal surfaces exposed by section XIV *, giving especial attention to the following structures :

<i>Medulla oblongata</i>	<i>Nucleus funiculi cuneati</i>	<i>Fasciculus longitudinalis medialis</i>
<i>Ventriculus quartus</i>	<i>N. glossopharyngeus</i>	
<i>Corpus restiforme</i>	<i>Fibrae arcuatae internae</i>	<i>Nucleus olivaris inferior</i>
<i>Nucleus n. hypoglossi</i>	<i>Substantia gelatinosa</i>	<i>Stratum interolivare lemnisci</i>
<i>N. hypoglossus</i>	<i>N. vagus</i>	
<i>Nucleus alae cinereae</i>	<i>Tractus spinalis n. trigemini</i>	<i>Fasciculi cerebrospinales</i>
	<i>Tractus solitarius</i>	<i>Nucleus arcuatus</i>

Draw either of the coronal surfaces exposed by section XV *, giving especial attention to the following structures :

<i>Medulla oblongata</i>	<i>Fibrae arcuatae externae</i>	<i>Tractus spinalis n. trigemini</i>
<i>Canalis centralis</i>		
<i>Fasciculus gracilis</i>	<i>Fibrae arcuatae internae</i>	<i>Substantia gelatinosa</i>
<i>Nucleus funiculi gracilis</i>		<i>Fasciculus cerebello-spinalis</i>
<i>Fasciculus cuneatus</i>	<i>Decussatio lemniscorum</i>	
<i>Nucleus funiculi cuneati</i>	<i>Fasciculus ventralis proprius</i>	<i>Fasciculi cerebrospinales</i>
<i>Nucleus commissuralis</i>		

* Refer to Outline No. 12.

Attach to the drawings the names of all visible structures mentioned in the nomenclature [B.N.A.].

Preserve the specimens in a four per cent. solution of formaldehyde.

OUTLINE NO. 17.

MEDULLA SPINALIS OF MAN.

Gross Study.

DIRECTIONS : Remove the *Meninges* of the *medulla spinalis*, leaving the proximal portion of the *nervi spinales* intact. Give especial attention to the following structures :

<i>Meninges</i>	<i>Medulla spinalis</i>	<i>Fissura mediana anterior</i>
<i>Dura mater spinalis</i>	<i>Pars cervicalis</i>	<i>Sulcus medianus posterior</i>
<i>Cavum subdurale</i>	<i>Intumescentia cervicalis</i>	<i>Sulcus lateralis anterior</i>
<i>Pia mater spinalis</i>	<i>Pars thoracalis</i>	<i>Sulcus lateralis posterior</i>
<i>Lig. denticulatum</i>	<i>Pars lumbalis</i>	<i>Sulcus intermedius posterior</i>
<i>Nervi spinales</i>	<i>Intumescentia lumbalis</i>	<i>(Sulcus intermedius anterior)</i>
<i>Radix anterior</i>	<i>Conus medullaris</i>	<i>Funiculus anterior</i>
<i>Radix posterior</i>	<i>Cauda equina</i>	<i>Funiculus lateralis</i>
<i>Ganglion spinale</i>	<i>Filum terminale</i>	<i>Funiculus posterior</i>

Draw the anterior, lateral and posterior aspects of the *intumescentia lumbalis* together with the portions of the *nervi spinales* dependent therefrom.

Attach to the drawings the names of all visible structures mentioned in the nomenclature [B.N.A.].

Preserve the specimens in a four per cent. solution of formaldehyde.

OUTLINE NO. 18.

MEDULLA SPINALIS OF MAN.

Gross Study.

DIRECTIONS : Divide the *medulla spinalis* into four segments by transverse sections as follows :

Section XVI to pass through the middle of the *intumescentia cervicalis*.

Section XVII to pass through the middle of the *pars thoracalis*.

Section XVIII to pass through the middle of the *intumescentia lumbalis*.

Draw the coronal surfaces thus exposed, giving especial attention to the following structures :

<i>Sulcus medianus posterior</i>	<i>Fasciculus anterolateralis superficialis</i>	<i>Substantia grisea centralis</i>
<i>Funiculus posterior</i>	<i>Fasciculus lateralis proprius</i>	<i>Commissura anterior alba</i>
<i>Fasciculus gracilis</i>	<i>Sulcus lateralis anterior</i>	<i>Commissura anterior grisea</i>
<i>Sulcus intermedius posterior</i>	<i>Funiculus anterior</i>	<i>Commissura posterior</i>
<i>Fasciculus cuneatus</i>	<i>Fasciculus cerebrospinalis anterior</i>	<i>Columna anterior</i>
<i>Sulcus lateralis posterior</i>	<i>Fasciculus anterior proprius</i>	<i>Columna lateralis</i>
<i>Funiculus lateralis</i>	<i>Fissura mediana anterior</i>	<i>Columna posterior</i>
<i>Fasciculus cerebrospinalis lateralis</i>	<i>Conus centralis</i>	<i>Apex columnae posterioris</i>
<i>Fasciculus cerebellospinalis</i>		<i>Substantia gelatinosa</i>
		<i>Formatio reticularis</i>
		<i>(Nucleus dorsalis)</i>

Attach to the drawings the names of all visible structures mentioned in the nomenclature [B.N.A.].

Preserve the specimens in a four per cent. solution of formaldehyde.

OUTLINE NO. 19.

CONDUCTION PATHS.

Reconstruction.

DIRECTIONS: With the aid of the drawings already made, together with the lecture notes and descriptive texts, construct diagrams illustrating the following conduction paths and the neurone systems of which these paths are composed :

I. THE GENERAL SENSORY CONDUCTION PATHS FROM THE SKIN, MUSCLES, ETC., TO THE CEREBRAL CORTEX :

A. The Direct Path :

1. The neurones of the first order, or the peripheral spinal and cerebral sensory neurones.
2. The sensory neurones of the second order (with crossed axones), (*nuclei terminales, fibrae arcuatae internae, decussatio lemniscorum, stratum interolivare lemnisci, lemniscus medialis, thalamus*).
3. The sensory neurones of the third order, or thalamocortical neurones (*thalamus, capsula interna [pars occipitalis], corona radiata, gyri centrales*).

B. The Indirect Path by the Way of the Cerebellum :

1. The peripheral spinal and cerebral sensory neurones.
2. The spino-cerebella neurones.
 - (a) Direct cerebellar tract (*nucleus dorsalis, fasciculus cerebello-pinalis, corpus restiforme, vermis*).
 - (b) Gowers' tract (*substantia grisea, medullae spinalis, fasciculus anterolateralis superficialis, vermis*).
3. The neurones whose axones constitute the *brachium conjunctivum* (*nucleus dentatus, brachium conjunctivum, decussatio brachii conjunctivi, nucleus ruber*).
4. The neurones extending from the *nucleus ruber* to the *pallium* (*nucleus ruber, capsula interna [pars occipitalis], gyri centrales, etc.*)

OUTLINE NO. 20.

CONDUCTION PATHS.

Reconstruction.

DIRECTIONS: With the aid of the drawings already made, together with the lecture notes and descriptive texts, construct diagrams illustrating the following conduction paths and the neurone systems of which these paths are composed ;

II. THE OLFACTORY CONDUCTION PATH.

1. Peripheral olfactory neurones (*regio olfactoria nasi, nn. olfactorii, bulbous olfactorius*).
2. Central olfactory neurones (*bulbus olfactorius, tractus olfactorius, lobus frontalis and lobus temporalis [uncus]*).

III. THE VISUAL CONDUCTION PATH.

1. Peripheral visual neurones (dipolar cells of retina).
2. Central visual neurones.
 - (a) From the retina to the *corpus geniculatum laterale* (ganglion cells of retina, *n. opticus*, *chiasma opticum*, *tractus opticus*, *corpus geniculatum laterale*).
 - (b) From the *corpus geniculatum laterale* to the *lobus occipitalis* (*corpus geniculatum laterale*, *capsula interna* [*pars occipitalis*], *radiatio occipitohthalmica* [*Gratioletii*], *cuneus*).
3. Neurones underlying optic reflexes.

IV. THE AUDITORY CONDUCTION PATH.

1. Peripheral auditory neurones (*organon spirale* [*Corti*], *ganglion spirale* [*Corti*], *n. cochleae*, *nuclei terminales*).
2. Central auditory neurones (*nucleus n. cochleae ventralis*, *nucleus n. cochleae dorsalis* [*tuberculum acusticum*], *corpus trapezoidum*, *striae medullares*, *superior olivary complex*, *lemniscus lateralis*, *nucleus lemnisci lateralis*, *nucleus colliculi inferioris*, *brachium quadrigeminum inferius*, *corpus geniculatum mediale*, *capsula interna* [*pars occipitalis*], *corona radiata*, *lobus temporalis* [*gyrus temp. sup.*, *gyri temp. transversii*]).

OUTLINE NO. 21.

CONDUCTION PATHS.

Reconstruction.

DIRECTIONS : With the aid of the drawings already made, together with the lecture notes and descriptive texts, construct diagrams illustrating the following conduction paths and the neurone systems of which these paths are composed :

V. THE GENERAL MOTOR CONDUCTION PATHS FROM THE CEREBRAL CORTEX TO THE MUSCLES.

A. Upper motor neurones (Cortico-nuclear motor neurones) :

1. Those governing motor nuclei of origin of the cerebral nerves (*gyri centrales*, *corona radiata*, *capsula interna* [*pars occipitalis*], *basis pedunculi*, motor nuclei of *n. oculomotorius*, *n. trochlearis*, *n. trigeminus*, *n. abducens*, *n. facialis*, *n. glossopharyngeus*, *n. vagus*, *n. accessorius* and *n. hypoglossus*).
2. Those governing motor nuclei of origin of the spinal nerves (*gyri centrales* and *lobulus paracentralis*, *corona radiata*, *capsula interna* [*pars occipitalis*], *basis pedunculi*, *fasciculi longitudinales pontis*, *fasciculi pyramidales*, *decussatio pyramidum*, *fasciculus cerebrospinalis lateralis* and *fasciculus cerebrospinalis anterior*, *columna grisea anterior* [*cornu anterius*]).

B. Lower motor neurones (Nucleo-muscular neurones) :

1. Those connecting the *mesencephalon* and *rhombencephalon* with muscles (motor nuclei of origin, roots and peripheral bundles pertaining to *n. oculomotorius*, *n. trochlearis*, *n. trigeminus*, *n. abducens*, *n. facialis*, *n. glossopharyngeus*, *n. vagus*, *n. accessorius*, *n. hypoglossus*).
2. Those connecting the *medulla spinales* with muscles (motor nuclei of origin [*columna anterior*], anterior roots and peripheral bundles pertaining to *nn. cervicales*, *nn. thoracales*, *nn. lumbales*, *nn. sacrales*, *n. coccygeus*).

OUTLINE NO. 22.

CONDUCTION PATHS.

Reconstruction.

DIRECTIONS: With the aid of the drawings already made, together with the lecture notes and descriptive texts, construct diagrams illustrating the following conduction paths and the neurone systems of which these paths are composed:

VI. THE CEREBRO-PONTO-CEREBELLAR PATHS.

A. Cerebro-cortico-pontal paths:

1. *Fasciculus palliopontilis* (*pars frontalis*), (feet of *gyri frontales*, *corona radiata*, *capsula interna* [*pars frontalis*], *basis pedunculi*, *fasciculi longitudinales pontis*, *nuclei pontis*).
2. *Fasciculus palliopontilis* (*pars occipitotemporalis*), (*lobus occipitalis* and *lobus temporalis*, *capsula interna*, *basis pedunculi*, *fasciculi longitudinalis pontis*, *nuclei pontis*).

B. Ponto-cerebellar path:

(*Nuclei pontis*, *brachia pontis*, *cortex cerebelli*).

VII. THE COMMISSURAL PATHS.

1. *Corpus callosum*.
2. *Commissura anterior cerebri*.
3. *Commissura hippocampi* (*Psalterium*).

VIII. THE ASSOCIATION PATHS.

A. Long paths:

1. *Cingulum* (*in gyrus fornicatus*).
2. *Fasciculus longitudinalis superior* (*lobus frontalis* and *lobus occipitalis*).

B. Short paths:

3. *Fasciculus uncinatus* (*uncus* and *lobus frontalis*).
4. *Fornix* (*hippocampus* and *substantia perforata anterior*).
5. *Tapetum* (*lobus frontalis* and *lobus occipitalis*).

The following additional outlines have been made out, and will be given in the course next year, the required material being prepared by a technical assistant:

SOPHOMORE NEUROLOGY.

OUTLINE NO. 16'.

ENCEPHALON OF MAN.

DIRECTIONS: Supplement the study of the fresh sections of the *pons* and the *medulla oblongata* by a study of corresponding sections of hardened tissue prepared according to the methods of Marchi and Weigert.

SOPHOMORE NEUROLOGY.

OUTLINE NO. 18'.

THE NEURONE AS A UNIT.

DIRECTIONS: Study the individual neurones in microscopic specimens prepared according to the methods of Golgi and Nissl.

Draw individual neurones as seen in the *cerebrum*, the *cerebellum*, the *medulla spinalis* and the *ganglia spinales*.

It is surprising how much students can be taught with the simple material prepared and presented in the way mentioned, and the results of the course have been so encouraging that the writers feel justified in recommending the adoption of similar methods in places where, owing to lack of time, laboratory facilities, material and a sufficient instructional force, more ideal courses in neurology cannot be given. A course of the nature outlined above is feasible in any medical school.

NOTE FROM CHARLES H. WARD.

ROCHESTER, N. Y., *December 23, 1900.*

I desire to inform you of the following facts concerning my paper on the Cranio-Mandibular Index, read at the Ithaca meeting December, 1897. The ratio between cranium and mandible suggested itself to me as of interest several years ago. Doctor J. Edward Line, of this city, then Editor of the *Odontographic Journal*, well posted on odontological matters, assured me, on inquiry, that, so far as he knew, no such comparison had been published.

The results of many hundreds of weighings were collected in my paper. The term Cranio-Mandibular naturally suggested itself as a good name for the proposed index. But on February 11, 1900, while glancing over a copy of the *American Anthropologist* of July 1891, a copy, by the way, whose leaves I cut as I read, I found on page 221 in an article by Doctor Robert Fletcher on "The New School of Criminal Anthropology," Orchanski had attempted to make a table showing the relation of the weight of the jaw to the cranium, or, as he terms it, the cranio-mandibular index.

THE LOBULE OF THE LUNG.

BY DR. W. S. MILLER, MADISON, WIS.

[Abstract.]

The term lobule as applied to the unit of the lung has been used in an exceedingly vague sense both by anatomists and pathologists. It is the purpose of the paper to give a definite meaning to the term.

THE EPITHELIUM OF THE PLEURAL CAVITIES.

BY DR. MILLER, MADISON, WIS.

[Abstract.]

Since the time of v. Recklinghausen and Oedmansson certain dark spots seen in many preparations of serous membranes stained by the silver-nitrate method have been called *stomata* and *stigmata*. Ludwig and Dybkowsky described such structures in the pleura. Muscatello has recently shown that such openings do not exist normally in the peritoneum. It is the purpose of the paper to show that they do not exist in the pleura when studied in the normal condition, and that they can be produced artificially at the pleasure of the investigator.

APPARATUS FOR DEMONSTRATING THE CIRCULATION OF THE BLOOD.

BY B. B. STROUD, B. S., D. SC., CORNELL UNIVERSITY.

The apparatus is an imitation of the actual blood vascular system. The heart, arteries, capillaries and veins are represented by a rubber bulb with valves, very elastic rubber tubing, capillary glass tubing and thinner rubber tubing. The bifurcation of arteries is shown in Y-shaped, of veins by U-shaped glass tubes. The circulation is continuous, as in the living body. Manometer tubes indicate the difference in pressure in arteries and veins.

Association
OF
American Anatomists

CONSTITUTION

List of Officers and Members

1902

1. The first part of the document is a list of names and addresses of the members of the committee.

**ASSOCIATION
OF
AMERICAN ANATOMISTS
1902**

CONSTITUTION

ARTICLE I.

Section 1. The name of the Society shall be the "Association of American Anatomists."

Section 2. The purpose of the Association shall be the advancement of anatomical science.

ARTICLE II.

The officers of the Association shall consist of a President, two Vice-Presidents, and a Secretary, who shall also act as Treasurer. The officers shall be elected by ballot every two years.

ARTICLE III.

The management of the affairs of the Association shall be delegated to an Executive Committee, consisting of seven members, including the President and Secretary, *ex officio*. One member of the Executive Committee shall be elected annually.

ARTICLE IV.

The Association shall meet annually, the time and place to be determined by the Executive Committee.

ARTICLE V.

Section 1. Candidates for membership must be persons engaged in teaching or in investigating in the anatomical sciences, and shall be proposed in writing to the Executive Committee by two members. Each proposal shall be made at or before the first session of any regular meeting of the Association. The proposal shall state the professional position or occupation of the candidate and the character of his investigations. The election shall take place in open meeting, a two-thirds vote being necessary.

Section 2. Honorary members may be elected from those not Americans who have distinguished themselves in anatomical research.

ARTICLE VI.

The annual dues shall be five dollars. A member in arrears for dues for two years shall be dropped by the Secretary at the next meeting of the Association, but may be reinstated, at the discretion of the Executive Committee, on payment of arrears.

ARTICLE VII.

Section 1. Five members shall constitute a quorum for the transaction of business.

Section 2. The ruling of the chairman shall be in accordance to "Roberts's Rules of Order."

ORDERS ADOPTED BY THE ASSOCIATION.

The election of delegates to the Executive Committee of the Congress of American Physicians and Surgeons shall take place every three years.

The maximum limit of time for the reading of papers shall be twenty minutes.

Brief abstracts of papers to be read, of not more than one hundred and fifty words each, shall be sent to the Secretary in time to appear in the program.

Contributors of papers are requested to furnish the Secretary with abstracts of not over two hundred words each, within a fortnight after the meeting, to appear in *Science*, failing receipt of which, the Secretary will send to *Science* such abstracts as may have appeared in the program.

The Secretary and Treasurer shall be allowed his traveling expenses, and the sum of \$10 toward payment of his hotel bill, at each session of the Association.

That the Association discontinue the separate publication of its proceedings, and that the *American Journal of Anatomy* be sent to each member of the Association, on payment of the annual dues, this journal to publish the proceedings of the Association, including an abstract of the papers read.

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Association
OF
American Anatomists

CONSTITUTION

LIST OF OFFICERS AND MEMBERS

1903

**ASSOCIATION
OF
AMERICAN ANATOMISTS
1903**



1

CONSTITUTION

ARTICLE I.

Section 1. The name of the Society shall be the "Association of American Anatomists."

Section 2. The purpose of the Association shall be the advancement of anatomical science.

ARTICLE II.

The officers of the Association shall consist of a President, two Vice-Presidents, and a Secretary, who shall also act as Treasurer. The officers shall be elected by ballot every two years.

ARTICLE III.

The management of the affairs of the Association shall be delegated to an Executive Committee, consisting of seven members, including the President and Secretary, *ex officio*. One member of the Executive Committee shall be elected annually.

ARTICLE IV.

The Association shall meet annually, the time and place to be determined by the Executive Committee.

ARTICLE V.

Section 1. Candidates for membership must be persons engaged in teaching or in investigating in the anatomical sciences, and shall be proposed in writing to the Executive Committee by two members. Each proposal shall be made at or before the first session of any regular meeting of the Association. The proposal shall state the official position or occupation of the candidate and the character of his investigations. The election shall take place in open meeting, a two-thirds vote being necessary.

Section 2. Honorary members may be elected from those not Americans who have distinguished themselves in anatomical research.

ARTICLE VI.

The annual dues shall be five dollars. A member in arrears for dues for two years shall be dropped by the Secretary at the next meeting of the Association, but may be reinstated, at the discretion of the Executive Committee, on payment of arrears.

ARTICLE VII.

Section 1. Five members shall constitute a quorum for the transaction of business.

Section 2. The ruling of the Chairman shall be in accordance to "Robert's Rules of Order."

ORDERS ADOPTED BY THE ASSOCIATION.

That any change in the constitution of this Association must be presented in writing at one meeting in order to receive consideration, and be acted upon at the next meeting; due notice of the proposed change to be sent to each member at least one month in advance of the meeting at which such action is to be taken.

The election of delegates to the Executive Committee of the Congress of American Physicians and Surgeons shall take place every three years.

Newly elected members must qualify by payment of dues for one year within thirty days after election.

The maximum limit of time for the reading of papers shall be twenty minutes.

The Secretary and Treasurer shall be allowed his traveling expenses and the sum of \$10 toward payment of his hotel bill, at each session of the Association.

That the Association discontinue the separate publication of its proceedings, and that the *American Journal of Anatomy* be sent to each member of the Association, on payment of the annual dues, this journal to publish the proceedings of the Association, including an abstract of the papers read.

Contributors of papers are requested to furnish the Secretary with abstracts within a fortnight after the meeting.

OFFICERS

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<i>First Vice-President</i>	.	.	.	DANIEL S. LAMB.
<i>Second Vice-President</i>	-	-	-	GEORGE PIERSOL.
<i>Secretary and Treasurer</i>	.	.	.	G. CARL HUBER.

Executive Committee.

FRANKLIN P. MALL	.	.	.	Term expiring in 1903.
CARL A. HAMANN	.	.	.	Term expiring in 1904.
LEWELLYS F. BARKER	.	.	.	Term expiring in 1905.
FREDERIC H. GERRISH	-	-	-	Term expiring in 1906.
CHARLES S. MINOT	.	.	.	Term expiring in 1907.

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Physicians and Surgeons, 1903-6.*

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Alternate,

FRANK BAKER.

*Delegate to the Council of the American Association for the
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SIMON H. GAGE.

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